

# Mathematical Reviews

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Index of Mathematical Papers Volume 11

Published by the American Mathematical Society

Providence, Rhode Island USA

ISSN 0025-5629

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- Jennings, Alan Matrices, ancient and modern. (57 #5613)
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## 65-06 Collections of papers; proceedings of conferences

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- Gingray, Michel ★ Dictionnaire d'informatique (Français-Anglais). **(58** #12)
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# 1980

# MATHEMATICS

# SUBJECT

# CLASSIFICATION

compiled in the Editorial Offices of MATHEMATICAL REVIEWS and ZENTRALBLATT FÜR MATHEMATIK

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# 1980 MATHEMATICS SUBJECT CLASSIFICATION

This is a corrected reprinting of the 1980 Mathematics Subject Classification. The corrections carried out since the first printing (in the 1978 Mathematical Reviews Index) include the following:

The entry “-00” at the beginning of each major section was dropped; classifiers should use “-XX” instead.

Section 08A02 has been instituted to accommodate some of the items from 08A05 in the 1970 classification (the whole of 08Axx now covers the 08A25 from 1970) and all items from the 08.20 in the 1968 classification; the majority of papers on “probabilistic metric spaces”, Menger spaces, etc. will belong in the new 08A02. The erroneous cross-references between 10C05 and 13K05 have been deleted. In 14, Moment problems were reinstated as 44A60, and Discrete operational calculus had to be relabeled 44A55. Sections 52A50 and 52A55 were reinstated. Section 63C65 was clarified. Section 65L07 was clarified and 65L20 added. Section 81C12 was split into 81C12 and 81C15. Sections 90C15 and 90C42 were combined into 90C15; sections 90C40, 90C45 and 90C47 were combined into 90C40.

The following sections are also new: 01-01, 01-02; 05C70, 05C75; 10K50; 22E41; 42A61; 46G12; 49A51, 49A55; 54B40; 73C02, 73C03, 73K40; 76B35, 76D35; 90A09; 93B50, 93B55.

## Instructions for using the 1980 Mathematics Subject Classification

These instructions apply uniformly to all fields listed. The main purpose of the classification is to help all readers to find the items of present or potential interest to them as readily as possible—in MR, in Zbl, or anywhere else where this classification system is used. The review of a paper or book should be printed in the section where it will receive the broadest attention from all readers possibly interested in it—these include both people working in that area and people who are familiar with that area and apply its results and methods elsewhere (inside or outside of mathematics). It will be extremely useful for both readers and classifiers to familiarize themselves with the entire classification system and thus to become

aware of all the classifications of possible interest to them.

Every paper or book reviewed in MR receives precisely one “primary” classification number; it is simply the number of the section in which the review of the item will be printed. This section should be the one that covers the principal contribution. When a paper contains several principal contributions in different areas, the primary classification should cover the “most important” among them. A paper or book may receive one or several “secondary” classification numbers (or “cross-references”), to cover any remaining principal contributions, ancillary results, motivation or origin of the problems discussed, intended or potential field of application, or other significant aspects worthy of notice.

The “primary” principal contribution should be the one including the most important part of the work actually done in the paper. For example, a paper whose main overall content is the solution of a problem in graph theory, which arose in computer science and whose solution is (perhaps) at present only of interest to computer scientists, should receive its primary classification in 05C and a cross-reference in 68; conversely, papers whose overall content lies mainly in computer science will receive a primary classification in 68, even if they make heavy use of graph theory and prove several new graph theoretic results along the way.

For any paper or book with its primary classification in (i.e., printed in) an “applied” section (68 through 94), it is recommended to give a cross-reference in some mathematics section(s) (00 through 65) whenever that is appropriate. Do not use 00A89 as a primary classification.

There are two types of cross-references given after many classifications in the list. The first type is of the form “(For A, see X)”;

if this appears in section Y, it means that for contributions described by A one should usually assign the classification X, not Y. The other type of cross-reference merely points out related classifications; it is of the form “[See also . . .]”, “[See mainly . . .]”, etc., and the classifications listed in the brackets may, but need not, be added to the classification of a paper, or they may be used in place of the classification where the cross-reference is given. The classifier will have to judge which classification is the most appropriate for the paper at hand.

## 00-XX GENERAL

- 00-01 Elementary exposition, textbooks
- 00-02 Advanced exposition (research surveys, monographs, etc.)
- 00A05 General mathematics
- 00A06 Mathematics for nonmathematicians (engineering, social sciences, etc.)
- 00A07 Problem books
- 00A10 Collections of papers; proceedings of conferences of general interest, translation volumes, etc. [See also 01A75.]
- 00A15 General bibliographies
- 00A20 Dictionaries and other general reference works
- 00A22 Formulas
- 00A25 Methodology and philosophy of mathematics
- 00A69 General applied mathematics (For cross reference to reviews printed in Sections 70 through 86, use 00A89.); theory of mathematical modeling
- 00A89 Physics (to be used in cross references to reviews printed in Sections 70 through 86, only when no other numbers from Sections 00 through 65 are suitable)
- 00A99 Miscellaneous topics

## 01-XX HISTORY AND BIOGRAPHY [See also the classification number -03 in the other sections.]

- 01-01 Elementary exposition, textbooks
- 01-02 Advanced exposition (research surveys, monographs, etc.)
- 01-06 Proceedings, conferences, etc.
- 01A05 General histories, source books
- 01A10 Primitive, Paleolithic, Neolithic
- 01A15 Pre-Greek, Egyptian
- 01A17 Babylonian
- 01A20 Greek
- 01A25 China
- 01A27 Japan
- 01A29 Southeast Asia
- 01A30 Islam (Medieval)

- 01A32 India
- 01A35 Medieval
- 01A40 15th and 16th centuries, Renaissance
- 01A45 17th century
- 01A50 18th century
- 01A55 19th century
- 01A60 20th century
- 01A65 Contemporary
- 01A70 Biographies, obituaries, personalia
- 01A72 Schools of mathematics
- 01A73 Universities
- 01A74 Other institutions and academies
- 01A75 Collected or selected works; reprintings or translations of classics
- 01A80 Sociology (and profession) of mathematics
- 01A99 Miscellaneous topics

## 03-XX MATHEMATICAL LOGIC AND FOUNDATIONS

- 03-01 Elementary exposition, textbooks
- 03-02 Advanced exposition (research surveys, monographs, etc.)
- 03-03 Historical (must also be assigned at least one classification number from Section 01)
- 03-04 Explicit machine computation and programs (not the theory of computation or programming)
- 03-06 Proceedings, conferences, etc.
- 03A05 Philosophical and critical
- 03Bxx General logic
- 03B05 Classical propositional logic
- 03B10 Pure first-order logic (including many-sorted logic)
- 03B15 Higher-order logic and type-theory
- 03B20 Fragments of classical logic
- 03B25 Decidability of theories and sets of sentences
- 03B30 Foundations of classical theories
- 03B35 Mechanical theorem proving
- 03B40 Combinatory logic and  $\lambda$ -calculus

- 03B45 Modal and tense logic, entailment, etc.  
 03B50 Many-valued logic  
 03B52 Fuzzy logic [See also 94D05.]  
 03B55 Intermediate logics  
 03B60 Other nonclassical logic  
 03B99 None of the above, but in this section
- 03Cxx Model theory**  
 03C05 Equational classes, universal algebra [See also 08Axx.]  
 03C10 Quantifier elimination and related topics  
 03C15 Countable models  
 03C20 Ultraproducts and related constructions  
 03C25 Model-theoretic forcing  
 03C30 Other model constructions  
 03C35 Categoricity and completeness  
 03C40 Preservation, interpolation, and definability theorems  
 03C45 Stability  
 03C50 Models with special properties (saturated, rigid, etc.)  
 03C52 Properties of classes of models  
 03C55 Set-theoretic model theory  
 03C60 Model-theoretic algebra [See also 08C10.]  
 03C65 Models of specific theories  
 03C70 Logic on admissible sets  
 03C75 Other infinitary logic  
 03C80 Logic with extra quantifiers and operators  
 03C85 Second- and higher-order model theory  
 03C90 Nonclassical models (Boolean-valued, sheaf, etc.)  
 03C95 Abstract model theory  
 03C99 None of the above, but in this section
- 03Dxx Recursion theory**  
 03D03 Thue and Post systems, etc.  
 03D05 Automata and formal grammars in connection with logical questions [See also 18B20, 68Dxx, 68F10.]  
 03D10 Turing machines and related notions [See also 68C40.]  
 03D15 Complexity of computation  
 03D20 Recursive functions and relations, subrecursive hierarchies  
 03D25 Recursively enumerable sets and degrees  
 03D30 Degrees and reducibilities  
 03D35 Undecidability and degrees of sets of sentences  
 03D40 Word problems, etc. [See also 06B25, 08A50, 20F10.]  
 03D45 Theory of numerations, effectively presented structures  
 03D50 Recursive equivalence types of sets and structures, isols  
 03D55 Hierarchies  
 03D60 Recursion theory on ordinals, admissible sets, etc.  
 03D65 Higher-type recursion theory  
 03D70 Inductive definability  
 03D75 Abstract and axiomatic recursion theory  
 03D80 Applications  
 03D99 None of the above, but in this section
- 03Exx Set theory [See also 04-XX.]**  
 03E05 Combinatorial set theory  
 03E10 Ordinal and cardinal arithmetic  
 03E15 Descriptive set theory  
 03E20 Other classical set theory  
 03E25 Axiom of choice and related propositions  
 03E30 Axiomatics of classical set theory and its fragments  
 03E35 Consistency and independence results  
 03E40 Other aspects of forcing and Boolean-valued models  
 03E45 Constructibility, ordinal definability, and related notions  
 03E50 Continuum hypothesis and Martin's axiom [See also 54A25.]  
 03E55 Large cardinals  
 03E60 Axiom of determinacy and other axioms which contradict the axiom of choice  
 03E65 Other hypotheses and axioms  
 03E70 Nonclassical and second-order set theories  
 03E72 Fuzzy sets [See also 54A40, 94D05.]  
 03E75 Applications  
 03E99 None of the above, but in this section
- 03Fxx Proof theory and constructive mathematics**  
 03F05 Cut-elimination and normal-form theorems  
 03F10 Functionals in proof theory  
 03F15 Recursive ordinals and ordinal notations  
 03F20 Complexity of proofs  
 03F25 Relative consistency and interpretations  
 03F30 First-order arithmetic and fragments  
 03F35 Second- and higher-order arithmetic and fragments [See also 03E30, 03E70.]  
 03F50 Metamathematics of constructive systems  
 03F55 Intuitionistic mathematics  
 03F60 Recursive analysis  
 03F65 Other constructive mathematics  
 03F99 None of the above, but in this section
- 03Gxx Algebraic logic**  
 03G05 Boolean algebras [See also 06Exx.]  
 03G10 Lattices and related structures [See also 06Bxx.]  
 03G12 Quantum logic [See also 81B10.]  
 03G15 Cylindric and polyadic algebras; relation algebras  
 03G20 Łukasiewicz and Post algebras  
 03G25 Other algebras related to logic  
 03G30 Categorical logic, topoi [See also 18B25.]  
 03G99 None of the above, but in this section
- 03Hxx Nonstandard models**  
 03H05 Infinitesimal analysis in pure mathematics [See also 26E35, 30G10, 54J05.]  
 03H10 Other applications of infinitesimal analysis  
 03H15 Nonstandard models of arithmetic [See also 10N15, 12L15, 13L15.]  
 03H20 Other nonstandard models [See also 54J05.]  
 03H99 None of the above, but in this section
- 04-XX SET THEORY**  
 04-01 Elementary exposition, textbooks  
 04-02 Advanced exposition (research surveys, monographs, etc.)  
 04-03 Historical (must also be assigned at least one classification number from Section 01)  
 04-04 Explicit machine computation and programs (not the theory of computation or programming)  
 04-06 Proceedings, conferences, etc.  
 04A05 Relations, functions [See also 08A02.]  
 04A10 Transfinite numbers  
 04A15 Descriptive set theory; Borel classifications; Suslin schemes, etc. [See also 03E15, 28A05, 54H05.]  
 04A20 Combinatorial [See also 05A05.]; filters  
 04A25 Axiom of choice and equivalent propositions (Zorn's lemma, etc.) [See also 03E25.]  
 04A30 Continuum hypothesis, generalized continuum hypothesis [See also 03E50, 54A25.]  
 04A99 Miscellaneous topics
- 05-XX COMBINATORICS (For finite fields, see 12Cxx.)**  
 05-01 Elementary exposition, textbooks  
 05-02 Advanced exposition (research surveys, monographs, etc.)  
 05-03 Historical (must also be assigned at least one classification number from Section 01)  
 05-04 Explicit machine computation and programs (not the theory of computation or programming)  
 05-06 Proceedings, conferences, etc.
- 05Axx Classical combinatorial problems**  
 05A05 Combinatorial choice problems (subsets, representatives, permutations)  
 05A10 Factorials, binomial coefficients, combinatorial functions  
 05A15 Combinatorial enumeration problems, generating functions  
 05A17 Partitions [See also 10A45.]  
 05A19 Combinatorial identities  
 05A20 Combinatorial inequalities  
 05A99 None of the above, but in this section
- 05Bxx Designs and configurations (For applications of design theory, see 94C30.)**  
 05B05 Block designs [See also 51E05, 62K10.]  
 05B10 Difference sets (number-theoretic, group-theoretic, etc.) [See also 10L05.]  
 05B15 Orthogonal arrays, Latin squares, Room squares  
 05B20 Matrices (incidence, Hadamard, etc.)  
 05B25 Finite geometries [See also 51D20, 51Exx.]  
 05B30 Other designs, configurations [See also 51E30.]  
 05B35 Matroids, geometric lattices



05B40 Packing and covering [See also 10E30, 52A45.]

05B45 Tessellation and tiling problems

05B50 Polyominoes

05B99 None of the above, but in this section

**05Cxx Graph theory (For applications of graphs, see 68D90, 68E10, 94C15.)**

05C05 Trees

05C10 Topological graph theory, imbedding [See also 57M15, 57M25.]

05C15 Chromatic theory of graphs and maps

05C20 Directed graphs (digraphs)

05C25 Graphs and groups [See also 20F32.]

05C30 Enumeration of graphs and maps

05C35 Extremal problems

05C38 Paths and cycles

05C40 Connectivity

05C45 Eulerian and Hamiltonian graphs

05C50 Graphs and matrices

05C55 Generalized Ramsey theory

05C60 Reconstruction conjecture

05C65 Hypergraphs

05C70 Factorization, matching, covering and packing

05C75 Structural characterization of types of graphs

05C99 None of the above, but in this section

**06-XX ORDER, LATTICES, ORDERED ALGEBRAIC STRUCTURES [See also 18B35.]**

06-01 Elementary exposition, textbooks

06-02 Advanced exposition (research surveys, monographs, etc.)

06-03 Historical (must also be assigned at least one classification number from Section 01)

06-04 Explicit machine computation and programs (not the theory of computation or programming)

06-06 Proceedings, conferences, etc.

**06Axx Ordered sets**

06A05 Total order

06A10 Partial order

06A12 Semilattices [See also 20M10.]

06A15 Galois correspondences, closure operators

06A23 Complete lattices, completions

06A99 None of the above, but in this section

**06Bxx Lattices [See also 03G10.]**

06B05 Structure theory

06B10 Ideals, congruence relations

06B15 Representation theory

06B20 Varieties of lattices

06B25 Free lattices, projective lattices, word problems [See also 03D40, 08A50, 20F10.]

06B30 Topological lattices, order topologies [See also 06F30, 54F05, 54H12.]

06B99 None of the above, but in this section

**06Cxx Modular lattices, complemented lattices**

06C05 Modular lattices, Desarguesian lattices

06C10 Semimodular lattices, geometric lattices

06C15 Complemented lattices, orthocomplemented lattices

06C20 Complemented modular lattices, continuous geometries

06C99 None of the above, but in this section

**06Dxx Distributive lattices**

06D05 Structure and representation theory

06D10 Complete distributivity

06D15 Pseudocomplemented lattices

06D20 Heyting algebras [See also 03Gxx.]

06D25 Post algebras [See also 03G20.]

06D30 DeMorgan algebras, Łukasiewicz algebras [See also 03G20.]

06D99 None of the above, but in this section

**06Exx Boolean algebras [See also 03G05.]**

06E05 Structure theory

06E10 Chain conditions, complete algebras

06E15 Topological representation

06E20 Boolean rings [See also 16A30, 16A32.]

06E99 None of the above, but in this section

**06Fxx Ordered structures [See also 22A26, 54F05.]**

06F05 Ordered semigroups [See also 20Mxx.]

06F10 Noether lattices

06F15 Ordered groups [See also 20F60.]

06F20 Ordered abelian groups, ordered linear spaces [See also 46A40.]

06F25 Ordered rings, algebras, modules (For ordered fields, see 10M15, 12J15; see also 13J25, 16A86.)

06F30 Topological lattices, order topologies [See also 06B30, 54F05, 54H12.]

06F99 None of the above, but in this section

**08-XX GENERAL MATHEMATICAL SYSTEMS**

08-01 Elementary exposition, textbooks

08-02 Advanced exposition (research surveys, monographs, etc.)

08-03 Historical (must also be assigned at least one classification number from Section 01)

08-04 Explicit machine computation and programs (not the theory of computation or programming)

08-06 Proceedings, conferences, etc.

**08Axx Universal algebra [See also 03C05.]**

08A02 Relational systems, laws of composition

08A05 Structure theory

08A30 Subalgebras, congruence relations

08A35 Automorphisms, endomorphisms

08A40 Operations, polynomials, primal algebras

08A45 Equational compactness

08A50 Word problems [See also 03D40, 20F10.]

08A55 Partial algebras

08A60 Unary algebras

08A65 Infinitary algebras

08A99 None of the above, but in this section

**08Bxx Varieties**

08B05 Equational logic, Mal'cev conditions

08B10 Congruence modularity, congruence distributivity

08B15 Lattices of varieties

08B20 Free algebras

08B25 Products, amalgamated products

08B30 Injectives, projectives

08B99 None of the above, but in this section

**08Cxx Classes of algebras**

08C05 Categories of algebras [See also 18C05.]

08C10 Axiomatic model classes [See also 03Cxx, in particular 03C60.]

08C15 Quasivarieties

08C99 None of the above, but in this section

**10-XX NUMBER THEORY (Excluding 10Axx and 10Mxx, this classification scheme does not distinguish work in the rational number fields from that in other algebraic number fields.)**

10-01 Elementary exposition, textbooks

10-02 Advanced exposition (research surveys, monographs, etc.)

10-03 Historical (must also be assigned at least one classification number from Section 01)

10-04 Explicit machine computation and programs (not the theory of computation or programming)

10-06 Proceedings, conferences, etc.

**10Axx Elementary number theory (For analogues in number fields, see 12A05.)**

10A05 Multiplicative structure of the integers (GCD, etc.)

10A10 Congruences, primitive roots

10A15 Power residues, reciprocity

10A20 Number-theoretic functions, related numbers; inversion formulas

10A21 Counting functions

10A22 Abstract theory of number-theoretic functions

10A25 Elementary prime number theory, factorization

10A30 Algorithms and expansions; digital properties (For metric results, see 10K10.)

10A32 Continued fractions (For approximation results, see 10F20; see also 30B70, 40A15.)

10A35 Recurrence sequences

- 10A40 Special numbers, sequences and polynomials (e.g. Bernoulli)
- 10A45 Partitions
- 10A99 None of the above, but in this section
- 10Bxx Diophantine equations [See also 14Gxx.]**
- 10B05 Linear, quadratic and bilinear equations
- 10B10 Cubic and quartic equations
- 10B15 Higher degree equations
- 10B16 Norm form equations
- 10B20 Multiplicative equations
- 10B25 Nonpolynomial equations
- 10B30 Equations in sufficiently many variables [See also 10J10.]
- 10B35 Representation problems [See also 10J10.]
- 10B40  $p$ -adic and power series fields
- 10B45 Diophantine inequalities
- 10B99 None of the above, but in this section
- 10Cxx Forms (especially quadratic) (For quadratic forms in linear algebra, see 15A63.)**
- 10C01 Forms over general fields (especially quadratic)
- 10C02 Forms over global rings and fields (especially quadratic)
- 10C03 Forms over local rings and fields (especially quadratic)
- 10C04 Forms over real fields
- 10C05 Quadratic, bilinear and Hermitian forms [See also 10E25.], general theory (including Witt rings of quadratic forms)
- 10C07 Class numbers of quadratic and Hermitian forms
- 10C10 Higher degree forms
- 10C15 Analytic theory (Einstein's zeta function; relations with automorphic forms and functions)
- 10C20  $p$ -adic theory
- 10C25 Minima of forms [See also 10E20.]
- 10C30 Arithmetic properties of classical groups [See also 20Gxx.]
- 10C99 None of the above, but in this section
- 10Dxx Theory of automorphic and modular functions and forms [See also 12A67, 12B27, 14Gxx, 14Kxx, 22E50, 22E55, 30F35, 32Nxx; for relations with quadratic forms, see 10C15.]**
- 10D05 Modular and automorphic functions
- 10D07 Structure of modular groups and generalizations, arithmetic groups [See also 20H05, 20H10, 22E40.]
- 10D12 Modular forms, one variable
- 10D15 Automorphic forms, one variable
- 10D20 Modular and automorphic forms, several variables
- 10D21 Hilbert modular forms and surfaces [See also 14J20.]
- 10D23 Congruence properties
- 10D24 Relations with Dirichlet series
- 10D25 Complex multiplication [See also 14K22.]
- 10D30  $p$ -adic theory, local fields [See also 14G20, 22E50.]
- 10D35 Galois properties
- 10D40 Representation-theoretic methods, trace formulas
- 10D45 Uniformization, periods and cohomology
- 10D99 None of the above, but in this section
- 10Exx Geometry of numbers**
- 10E05 Lattices and convex bodies [See also 10J25.]
- 10E10 Nonconvex bodies
- 10E15 Products of linear forms
- 10E20 Minima of forms [See also 10C25.]
- 10E25 Quadratic forms (reduction, extreme forms, etc.) [See also 10C05.]
- 10E30 Lattice packing and covering [See also 05B40, 52A45.]
- 10E35 Mean value theorems
- 10E40 Transfer theorems
- 10E45 Automorphism groups of lattices [See also 10C30.]
- 10E99 None of the above, but in this section
- 10Fxx Diophantine approximation [See also 10K15.]**
- 10F05 Approximation to one number
- 10F10 Simultaneous approximation
- 10F15 Nonhomogeneous approximation
- 10F20 Continued fractions and generalizations [See also 10A32, 10K10.]
- 10F25 Approximation to algebraic numbers
- 10F30 Approximation by numbers from a fixed field
- 10F35 Irrationality and transcendence
- 10F37 Independence results
- 10F40 Distribution modulo one [See also 10K05.]
- 10F45 Approximation in non-Archimedean valuations
- 10F99 None of the above, but in this section
- 10Gxx Trigonometric sums, exponential sums and character sums**
- 10G05 Exponential sums
- 10G10 Estimates on exponential sums
- 10G15 Character sums
- 10G20 Estimates on character sums
- 10G99 None of the above, but in this section
- 10Hxx Multiplicative theory**
- 10H05 Riemann's zeta function, functional equation
- 10H08 Dirichlet  $L$ -function, functional equation
- 10H10 Other zeta functions (For local and global ground fields, see 12A70, 12A80, 12B30, 12B35; for algebro-geometric methods, see 14G10; see also 10C15, 10D40.)
- 10H15 Distribution of primes and of integers with specified multiplicative properties
- 10H20 Distribution in progressions and other sequences [See also 10L20.]
- 10H22 Turán theory
- 10H25 Asymptotic results on arithmetic functions
- 10H26 Asymptotic results on counting functions for algebraic and topological structures
- 10H30 Sieves, upper and lower estimates
- 10H32 Applications of sieve methods
- 10H35 Distribution of residue classes (primitive roots, power residues, etc.)
- 10H40 Generalized primes and integers
- 10H45 Almost-periodic number-theoretic functions [See also 10K35.]
- 10H99 None of the above, but in this section
- 10Jxx Additive theory**
- 10J05 Sums of squares
- 10J06 Sums of higher powers
- 10J10 Applications of Hardy-Littlewood method [See also 10B35.]
- 10J15 Additive questions involving primes
- 10J20 Analytic work on partitions [See also 10A45.]
- 10J25 Lattice points in large regions
- 10J99 None of the above, but in this section
- 10Kxx Probabilistic theory; measure, dimension, etc.**
- 10K05 Distribution modulo one [See also 10F40.]
- 10K10 Algorithms and expansions [See also 10A30, 10F20.]
- 10K15 Diophantine approximation [See also 10Fxx.]
- 10K20 Arithmetic functions
- 10K25 Normal numbers
- 10K30 Irregularities of distribution
- 10K35 Harmonic analysis and almost periodicity [See also 10H45.]
- 10K40 Non-Archimedean theory
- 10K50 Measure; Hausdorff dimension
- 10K99 None of the above, but in this section
- 10Lxx Sequences of integers**
- 10L02 Density of sum sets, analogues and generalizations
- 10L05 Addition of sequences, additive bases [See also 05B10.]
- 10L10 Special sequences (density, multiplicative, additive and other properties)
- 10L15 Representation functions
- 10L20 Arithmetic progressions [See also 10H20.]
- 10L99 None of the above, but in this section
- 10Mxx Rational arithmetic of algebraic objects**
- 10M05 Polynomials [See also 13F20.]
- 10M10 Valued fields [See also 12J10.]
- 10M15 Ordered fields [See also 12J15.]
- 10M20 Matrices [See also 15A36.]
- 10M99 None of the above, but in this section
- 10Nxx Connections with logic**
- 10N05 Decidability [See also 03B25.]
- 10N10 Ultraproducts [See also 03C20.]
- 10N15 Nonstandard arithmetic [See also 03H15.]
- 10N99 None of the above, but in this section



**2-XX ALGEBRAIC NUMBER THEORY, FIELD THEORY AND POLYNOMIALS**

- 12-01 Elementary exposition, textbooks
- 12-02 Advanced exposition (research surveys, monographs, etc.)
- 12-03 Historical (must also be assigned at least one classification number from Section 01)
- 12-04 Explicit machine computation and programs (not the theory of computation or programming)
- 12-06 Proceedings, conferences, etc.
- 12Axx Algebraic number theory: global fields {For complex multiplication, see 10D25.}**
  - 12A05 Analogues in number fields of elementary number theory
  - 12A10 Characterizations of algebraic numbers and algebraic functions
  - 12A15 Special algebraic numbers (PV numbers, etc.)
  - 12A20 Polynomials (irreducibility, etc.)
  - 12A25 Quadratic fields
  - 12A30 Cubic and quartic fields
  - 12A35 Abelian and metabelian extensions (including cyclotomic, Kummer, cyclic)
  - 12A40 Other number fields
  - 12A45 Units and factorization
  - 12A50 Class number, discriminant
  - 12A55 Galois theory
  - 12A57 Integral representations related to algebraic numbers [See also 20C10.]
  - 12A60 Galois cohomology [See also 12Gxx, 16A16.]
  - 12A62 Applications of algebraic  $K$ -theory
  - 12A65 Class field theory
  - 12A67 Langlands-Weil conjectures, nonabelian class field theory [See also 10Dxx, 22E55.]
  - 12A70 Zeta functions of number fields and generalizations [See also 10H08, 10H10.]
  - 12A75 Density theorems
  - 12A80 Arithmetic of algebras [See also 12B35, 16A18, 16A39.]
  - 12A82 Zeta functions of algebras
  - 12A85 Analysis in adèle rings and groups
  - 12A90 Arithmetic theory of algebraic function fields [See also 14-XX.]
  - 12A95 Totally real and totally positive fields
  - 12A99 None of the above, but in this section
- 12Bxx Algebraic number theory: local and  $p$ -adic fields**
  - 12B05 Polynomials
  - 12B10 Ramification and extension theory
  - 12B15 Galois theory
  - 12B17 Integral representations
  - 12B20 Galois cohomology [See also 12Gxx, 16A16.]
  - 12B22 Applications of algebraic  $K$ -theory
  - 12B25 Class field theory
  - 12B27 Langlands-Weil conjectures, nonabelian class field theory [See also 10Dxx, 22E50.]
  - 12B30 Zeta and  $L$ -functions [See also 10H08, 10H10.]
  - 12B35 Arithmetic of algebras [See also 12A80, 16A18, 16A39.]
  - 12B37 Zeta functions of algebras
  - 12B40 Other analytic theory
  - 12B45 Other nonanalytic theory
  - 12B99 None of the above, but in this section
- 12Cxx Finite fields, and finite commutative rings (number-theoretic aspects)**
  - 12C05 Polynomials
  - 12C10 Linear sequences
  - 12C15 Arithmetic
  - 12C20 Cyclotomy
  - 12C25 Exponential sums
  - 12C30 Structure theory
  - 12C99 None of the above, but in this section
- 12Dxx Real and complex fields**
  - 12D05 Polynomials: factorization
  - 12D10 Polynomials: location of zeros (algebraic theorems) {For the analytic theory, see 26C10, 30C15.}
  - 12D15 Formally real fields
  - 12D99 None of the above, but in this section

- 12Exx General field theory**
  - 12E05 Polynomials (irreducibility, etc.)
  - 12E10 Special polynomials
  - 12E12 Equations
  - 12E15 Skew fields, division rings [See also 12A80, 12B35, 16A39.]
  - 12E99 None of the above, but in this section
- 12Fxx Field extensions**
  - 12F05 Algebraic extensions
  - 12F10 Separable extensions, Galois theory
  - 12F15 Inseparable extensions, derivations
  - 12F20 Transcendental extensions
  - 12F99 None of the above, but in this section
- 12Gxx Homological methods**
  - 12G05 Galois cohomology [See also 12A60, 12B20, 13A20, 16A16.]
  - 12G10 Cohomological dimension
  - 12G99 None of the above, but in this section
- 12Hxx Differential and difference algebra**
  - 12H05 Differential algebra [See also 13N05.]
  - 12H10 Difference algebra [See also 39Axx.]
  - 12H20 Abstract differential equations [See also 34G05.]
  - 12H25  $p$ -adic differential equations [See also 12B40, 14G20, 34G05.]
  - 12H99 None of the above, but in this section
- 12Jxx Topological fields**
  - 12J05 Normed fields
  - 12J10 Valued fields [See also 10M10.]
  - 12J15 Ordered fields [See also 10M15.]
  - 12J17 Topological semi-fields
  - 12J20 General valuation theory
  - 12J25 Non-Archimedean valued fields [See also 26E30, 30G05, 32D25, 46P05.]
  - 12J27 Krasner-Tate algebras [See mainly 32E27, also 46P05.]
  - 12J99 None of the above, but in this section
- 12Kxx Generalizations**
  - 12K05 Near-fields [See also 16A76.]
  - 12K10 Semi-fields [See also 16A78.]
  - 12K99 None of the above, but in this section
- 12Lxx Connections with logic**
  - 12L05 Decidability
  - 12L10 Ultraproducts
  - 12L15 Nonstandard arithmetic [See also 03H15.]
  - 12L99 None of the above, but in this section
- 13-XX COMMUTATIVE RINGS AND ALGEBRAS {For the noncommutative case, see 16-XX.}**
  - 13-01 Elementary exposition, textbooks
  - 13-02 Advanced exposition (research surveys, monographs, etc.)
  - 13-03 Historical (must also be assigned at least one classification number from Section 01)
  - 13-04 Explicit machine computation and programs (not the theory of computation or programming)
  - 13-06 Proceedings, conferences, etc.
- 13Axx General commutative ring theory**
  - 13A05 Divisibility
  - 13A10 Radical theory
  - 13A15 Ideals
  - 13A17 Prime and primary ideals and their generalizations
  - 13A18 Valuations and their generalizations
  - 13A20 Brauer groups [See also 12Gxx, 16A16.]
  - 13A99 None of the above, but in this section
- 13Bxx Ring extensions and related topics**
  - 13B02 Extension theory
  - 13B05 Galois theory
  - 13B10 Automorphisms and derivations
  - 13B15 Ramification theory
  - 13B20 Integral dependence; integral closure; integrally closed rings, related rings (Japanese, etc.)
  - 13B25 Polynomials over commutative rings
  - 13B30 Quotients and localization
  - 13B99 None of the above, but in this section

**13Cxx Theory of modules and ideals**

- 13C05 Structure, classification theorems
- 13C10 Projective and free modules and ideals [See also 18G05.]
- 13C11 Injective and flat modules and ideals [See also 18G05.]
- 13C12 Torsion modules and ideals
- 13C13 Other special types
- 13C15 Dimension theory, depth, related rings (catenary, etc.)
- 13C99 None of the above, but in this section

**13Dxx Homological methods**

- 13D03 Cohomology of commutative rings and algebras
- 13D05 Homological dimension
- 13D10 Deformations and infinitesimal methods [See also 14D15, 16A58, 32Gxx.]
- 13D15 Grothendieck group,  $K$ -theory [See also 14F15, 18F25, 18F30.]
- 13D25 Complexes [See also 14Mxx.]
- 13D30 Torsion theory [See also 13C12, 16A63, 18E40.]
- 13D99 None of the above, but in this section

**13Exx Chain conditions, finiteness conditions**

- 13E05 Noetherian rings and modules
- 13E10 Artinian rings and modules, finite-dimensional algebras
- 13E15 Rings and modules of finite generation or representation
- 13E99 None of the above, but in this section

**13Fxx Arithmetic rings [See also 12-XX.]**

- 13F05 Dedekind and Prüfer rings and their generalizations
- 13F07 Euclidean rings and generalizations
- 13F10 Principal ideal rings
- 13F15 Factorial rings, unique factorization domains
- 13F20 Polynomial rings [See also 10M05.]
- 13F25 Formal power series rings
- 13F30 Discrete valuation rings
- 13F99 None of the above, but in this section

**13G05 Integral domains****13Hxx Local rings and semilocal rings**

- 13H05 Regular local rings
- 13H10 Special types (Macaulay, Gorenstein, etc.)
- 13H15 Multiplicity theory and related topics
- 13H99 None of the above, but in this section

**13Jxx Topological rings [See also 16A80.]**

- 13J05 Power series rings
- 13J10 Complete rings
- 13J15 Henselian rings
- 13J20 Global topological rings
- 13J25 Ordered rings [See also 06F25, 16A86.]
- 13J99 None of the above, but in this section

**13K05 Witt vectors and related rings**

- 13L05 Applications of logic to commutative algebra [See also 03Cxx, 03Hxx.]

**13Mxx Finite commutative rings {For number-theoretic aspects, see 12Cxx.}**

- 13M05 Structure
- 13M10 Polynomials
- 13M99 None of the above, but in this section

**13N05 Differential algebra [See also 12H05.]****14-XX ALGEBRAIC GEOMETRY**

- 14-01 Elementary exposition, textbooks
- 14-02 Advanced exposition (research surveys, monographs, etc.)
- 14-03 Historical (must also be assigned at least one classification number from Section 01)
- 14-04 Explicit machine computation and programs (not the theory of computation or programming)
- 14-06 Proceedings, conferences, etc.

**14Axx Foundations**

- 14A05 Relevant commutative algebra [See also 13-XX.]
- 14A10 Varieties
- 14A15 Schemes
- 14A20 Generalizations (algebraic spaces, motifs)
- 14A25 Elementary questions
- 14A99 None of the above, but in this section

**14Bxx Local theory [See also 32Bxx.]**

- 14B05 Singularities [See also 14E15, 32B30, 32C40, 58C27.]
- 14B07 Deformations of singularities [See also 14D15, 32C40, 32G05, 32G11, 32G13.]
- 14B10 Infinitesimal methods
- 14B12 Local deformation theory, Artin approximation, etc.
- 14B15 Local cohomology [See also 32C36.]
- 14B20 Formal neighborhoods
- 14B25 Local structure of maps: étale, flat, etc. [See also 13-XX, 14E40.]
- 14B99 None of the above, but in this section

**14Cxx Cycles and subschemes**

- 14C05 Parametrization (Chow and Hilbert schemes)
- 14C10 Equivalence relations
- 14C15 Rational equivalence rings
- 14C17 Intersection theory
- 14C20 Divisors, linear systems
- 14C21 Webs, nets [See also 53A60.]
- 14C22 Picard groups
- 14C25 Zero-cycles
- 14C30 Transcendental methods, Hodge theory [See also 32J25.]
- 14C35 Applications of methods of algebraic  $K$ -theory [See also 14F05, 18F25.]
- 14C40 Riemann-Roch theorems [See also 14F12.]
- 14C99 None of the above, but in this section

**14Dxx Families, fibrations**

- 14D05 Structure of families (Picard-Lefschetz, Picard-Fuchs theory, etc.)
- 14D10 Arithmetic ground fields (finite, local, global)
- 14D15 Formal methods; deformations [See also 13D10, 14B07, 16A58, 32Gxx.]
- 14D20 Algebraic moduli problems {For analytic moduli problems, see 32G13.}
- 14D22 Fine structure of moduli spaces
- 14D25 Geometric invariants [See also 14L30.]
- 14D99 None of the above, but in this section

**14Exx Mappings and correspondences**

- 14E05 Rational maps, birational correspondences
- 14E07 Structure of Cremona group and generalizations
- 14E10 General correspondences
- 14E15 Global theory of singularities, resolution [See also 14B05, 32C45.]
- 14E20 Coverings, fundamental group
- 14E22 Ramification problems [See also 12B10.]
- 14E25 Imbeddings
- 14E30 Minimal models
- 14E35 Results in dimension  $\leq 3$
- 14E40 Local structure of maps: étale, flat, etc. [See also 13-XX, 14B25.]
- 14E99 None of the above, but in this section

**14Fxx Cohomology theory [See also 13Dxx.]**

- 14F05 Vector bundles, sheaves, related constructions [See also 18F20, 46M20.]
- 14F07 Weierstrass points in one and several variables; gap sheaves
- 14F10 Differentials and other special sheaves
- 14F12 Riemann-Roch problems [See mainly 14C40, also 32L10, 57R20.]
- 14F15 Serre cohomology,  $K$ -theory [See also 13D15, 18F25.]
- 14F20 Grothendieck cohomology and topology [See also 18F10.]
- 14F25 Classical real and complex cohomology
- 14F30  $p$ -adic cohomology, crystalline cohomology
- 14F35 Homotopy theory
- 14F40 de Rham cohomology [See also 14C30, 32C35, 32L10.]
- 14F45 Topological properties
- 14F99 None of the above, but in this section

**14Gxx Special ground fields, arithmetic problems {For complex multiplication, see 10D25, 14K22. For automorphic and modular functions and forms, see also 10Dxx, 14K15.}**

- 14G05 Rationality questions



- 14G10 Zeta functions and related questions [See also 12A70, 12B30.]
- 14G13 Weil-Tate conjectures [See also 14Cxx.]
- 14G15 Finite ground fields
- 14G20  $p$ -adic ground fields (local fields)
- 14G25 Global ground fields
- 14G30 Real ground fields [See also 32C05. Must also be assigned at least one other number referring to the specific type of problem considered.]
- 14G99 None of the above, but in this section
- 14Hxx Curves**
- 14H05 Algebraic functions [See also 14K20, 32G20.]
- 14H10 Families, moduli (algebraic)
- 14H15 Families, moduli (analytic) [See also 30F10, 32G15, 32G20.]
- 14H20 Singularities, local rings [See also 13Hxx.]
- 14H25 Arithmetic ground fields [See also 10Bxx, 14Gxx.]
- 14H30 Coverings, fundamental group
- 14H35 Correspondences [See also 14Exx.]
- 14H40 Jacobians [See also 32G20.]
- 14H45 Special curves
- 14H99 None of the above, but in this section
- 14Jxx Surfaces and higher-dimensional varieties**
- 14J05 Picard group
- 14J10 Families, moduli, classification: algebraic theory
- 14J15 Moduli, classification: analytic theory [See also 32J15.]
- 14J17 Singularities of surfaces
- 14J20 Arithmetic ground fields [See also 10Bxx, 14Gxx.]
- 14J25 Special surfaces
- 14J30 Special 3-folds [See also 14E05.]
- 14J35 Special 4-folds [See also 14E05.]
- 14J40 Special  $n$ -folds
- 14J99 None of the above, but in this section
- 14Kxx Abelian varieties and schemes**
- 14K05 Algebraic theory
- 14K07 Elliptic curves, one-dimensional theory [See also 14H50.]
- 14K10 Algebraic moduli, classification
- 14K15 Arithmetic ground fields [See also 10Bxx, 10Dxx, 14Gxx.]
- 14K20 Analytic theory; abelian integrals and differentials
- 14K22 Complex multiplication [See also 10D25.]
- 14K25 Theta functions
- 14K30 Picard schemes, higher Jacobians
- 14K99 None of the above, but in this section
- 14Lxx Group schemes {For linear algebraic groups, see 20Gxx. For Lie algebras, see 17B45.}**
- 14L05 Formal groups,  $p$ -divisible groups [See also 17B50.]
- 14L10 Group varieties
- 14L15 Group schemes
- 14L17 Affine algebraic groups, hyperalgebra constructions [See also 17B45, 18D35.]
- 14L20 Finite group schemes
- 14L25 Pro-algebraic group schemes
- 14L30 Group actions on varieties or schemes [See also 14D25.]
- 14L35 Classical groups (geometric aspects)
- 14L40 Other algebraic groups (geometric aspects)
- 14L99 None of the above, but in this section
- 14Mxx Special varieties**
- 14M05 Varieties defined by ring conditions (factorial, Macaulay)
- 14M07 Low-codimension problems [See also 14Cxx.]
- 14M10 Complete intersections
- 14M12 Determinantal varieties
- 14M15 Grassmannians, Schubert varieties [See also 51M35.]
- 14M17 Homogeneous spaces [See also 32M10, 53C30, 57T15.]
- 14M20 Rational varieties
- 14M99 None of the above, but in this section
- 14Nxx Classical methods and problems [See also 51-XX.]**
- 14N05 Projective techniques
- 14N10 Enumerative problems
- 14N99 None of the above, but in this section
- 5-XX LINEAR AND MULTILINEAR ALGEBRA; MATRIX THEORY (finite and infinite)**
- 15-01 Elementary exposition, textbooks
- 15-02 Advanced exposition (research surveys, monographs, etc.)
- 15-03 Historical (must also be assigned at least one classification number from Section 01)
- 15-04 Explicit machine computation and programs (not the theory of computation or programming)
- 15-06 Proceedings, conferences, etc.
- 15A03 Vector spaces, linear dependence, rank
- 15A04 Linear transformations, semilinear transformations
- 15A06 Linear equations
- 15A09 Matrix inversion, generalized inverses
- 15A12 Conditioning of matrices [See also 65F35.]
- 15A15 Determinants, permanents, other special matrix functions
- 15A18 Eigenvalues, singular values, and eigenvectors
- 15A21 Canonical forms, reductions, classification
- 15A23 Factorization of matrices
- 15A24 Matrix equations and identities
- 15A27 Commutativity
- 15A30 Algebraic systems of matrices [See also 16A42, 20Gxx, 20Hxx.]
- 15A33 Matrices over special rings (quaternions, finite fields, etc.)
- 15A36 Matrices of integers [See also 10M20.]
- 15A39 Linear inequalities
- 15A42 Inequalities involving eigenvalues and eigenvectors
- 15A45 Miscellaneous inequalities involving matrices
- 15A48 Positive matrices and their generalizations
- 15A51 Stochastic matrices
- 15A52 Random matrices
- 15A54 Matrices over function rings in one or more variables
- 15A57 Other types of matrices (Hermitian, skew-Hermitian, etc.)
- 15A60 Norms of matrices, numerical range, applications of functional analysis to matrix theory [See also 65F35, 65J05.]
- 15A63 Quadratic and bilinear forms, inner products [See mainly 10Cxx.]
- 15A66 Clifford algebras
- 15A69 Multilinear algebra, tensor products
- 15A72 Vector and tensor algebra, theory of invariants
- 15A75 Exterior algebra, Grassmann algebras
- 15A78 Other algebras built from modules
- 15A90 Applications to physics
- 15A99 Miscellaneous topics
- 16-XX ASSOCIATIVE RINGS AND ALGEBRAS {For the commutative case, see 13-XX.}**
- 16-01 Elementary exposition, textbooks
- 16-02 Advanced exposition (research surveys, monographs, etc.)
- 16-03 Historical (must also be assigned at least one classification number from Section 01)
- 16-04 Explicit machine computation and programs (not the theory of computation or programming)
- 16-06 Proceedings, conferences, etc.
- 16A02 Integral domains, unique factorization domains (noncommutative)
- 16A03 Graded algebras, rings and modules
- 16A04 Noncommutative principal ideal rings, rings with a division algorithm
- 16A05 Skew polynomial rings, power series rings
- 16A06 Free algebras, free ideal rings (firs) and their generalizations [See also tensor algebra in 15A72.]
- 16A08 Rings of quotients, noncommutative localization
- 16A10 Noncommutative local rings
- 16A12 Prime and semiprime rings
- 16A14 Noncommutative analogues of Dedekind and Prüfer domains
- 16A15 Other generalizations of commutative rings {For commutativity theorems, see 16A70.}
- 16A16 Separable algebras, Azumaya algebras and their generalizations [See also 12Gxx, 13A20.]
- 16A18 Orders, arithmetic in algebras [See also 12A80, 12B35.]
- 16A19 Simple non-Artinian rings
- 16A20 Primitive and semiprimitive rings
- 16A21 Radical theory
- 16A22 Nil, nilpotent and radical rings
- 16A24 Hopf algebras, algebraic theory [See also 57T05.]

- 16A25 Structure of groups of units of rings
- 16A26 Group rings of finite groups [See also 20C05; for semigroup rings, see 20M25.]
- 16A27 Group rings of infinite groups [See also 20C07; for semigroup rings, see 20M25.]
- 16A28 Rings with involution [See also 46Kxx.]
- 16A30 von Neumann regular rings and their generalizations [See also 06Cxx, 06Exx.]
- 16A32 Idempotents in rings [See also 06Exx.]
- 16A33 Noetherian rings
- 16A34 Rings with annihilator conditions, chain conditions (Goldie rings)
- 16A35 Artinian rings
- 16A36 Frobenius algebras, quasi-Frobenius rings and their generalizations
- 16A38 Rings with polynomial identity
- 16A39 Skew fields [See also 12E15.], division rings
- 16A40 Simple and semisimple Artinian rings
- 16A42 Rings of linear transformations, matrix rings, infinite matrix rings [See also 15A30.]
- 16A44 Finite rings [See also 12Cxx, 13Mxx.]
- 16A45 Other types of rings and algebras
- 16A46 Finite-dimensional algebras
- 16A48 Structure, classification
- 16A49 Duality theory
- 16A50 Projective and flat modules and generalizations
- 16A51 Perfect, semiperfect rings and modules and their generalizations
- 16A52 Injective modules, self-injective rings and generalizations
- 16A53 Special types of modules
- 16A54 Grothendieck groups of rings,  $K$ -theory of noncommutative rings [See also 18F25, 18F30.]
- 16A55 Dimension theory (Krull, Gabriel)
- 16A56 Extension theory
- 16A58 Deformation theory of rings and algebras [See also 13D10, 14D15, 32Gxx.]
- 16A60 Homological dimension
- 16A61 Cohomology of algebras and rings
- 16A62 Homological methods
- 16A63 Torsion theories [See also 13D30, 18E40.]
- 16A64 Modules and representations
- 16A65 Endomorphism rings
- 16A66 Ideal theory, prime ideals and their generalizations
- 16A68 Lie, Jordan and other nonassociative structures on associative rings
- 16A70 Commutativity theorems
- 16A72 Automorphisms, derivations, other morphisms
- 16A74 Galois theory
- 16A76 Near-rings [See also 12K05.]
- 16A78 Semirings and other generalizations of rings
- 16A80 Topological rings and modules [See also 13Jxx.]
- 16A86 Ordered rings [See also 06F25.]
- 16A89 Equivalence of module categories
- 16A90 Categorical methods and categorical ring theory
- 16A99 Miscellaneous topics
- 17-XX NONASSOCIATIVE RINGS AND ALGEBRAS**
  - 17-01 Elementary exposition, textbooks
  - 17-02 Advanced exposition (research surveys, monographs, etc.)
  - 17-03 Historical (must also be assigned at least one classification number from Section 01)
  - 17-04 Explicit machine computation and programs (not the theory of computation or programming)
  - 17-06 Proceedings, conferences, etc.
- 17Axx General nonassociative rings**
  - 17A01 General theory
  - 17A05 Power-associative
  - 17A10 Commutative power-associative
  - 17A15 Noncommutative Jordan algebras
  - 17A20 Flexible algebras
  - 17A25 Nodal algebras
  - 17A30 Algebras satisfying other identities
  - 17A35 Division algebras
  - 17A40 Ternary compositions
  - 17A42 Other  $n$ -ary compositions
  - 17A45 Quadratic algebras (not quadratic Jordan algebras)
  - 17A50 Free algebras
  - 17A60 Structure theory in general nonassociative rings
  - 17A65 Radical theory in general nonassociative rings
  - 17A70 Super algebras
  - 17A99 None of the above, but in this section
- 17Bxx Lie algebras (For Lie groups, see 22Exx.)**
  - 17B05 Structure theory
  - 17B10 Representations, algebraic theory (weights)
  - 17B15 Representations, analytic theory
  - 17B20 Simple, semisimple, reductive algebras (roots)
  - 17B25 Exceptional algebras
  - 17B30 Solvable, nilpotent algebras
  - 17B35 Universal enveloping algebras, imbeddings
  - 17B40 Automorphisms, derivations, other operators
  - 17B45 Lie algebras of linear algebraic groups [See also 14Lxx and 20Gxx.]
  - 17B50 Modular Lie algebras
  - 17B55 Homological methods in Lie algebras
  - 17B56 Cohomology of Lie algebras
  - 17B60 Lie rings associated with other structures (associative, Jordan, etc.) [See also 15A30, 16A68, 17C40, 17C50.]
  - 17B65 Infinite-dimensional Lie algebras [See also 22E65.]
  - 17B70 Graded Lie algebras
  - 17B99 None of the above, but in this section
- 17Cxx Jordan algebras (commutative)**
  - 17C05 Identities
  - 17C10 Structure theory
  - 17C15 Representations
  - 17C20 Simple, semisimple algebras
  - 17C25 Universal enveloping algebras
  - 17C30 Automorphisms, derivations, other operators
  - 17C35 Formally real domains of positivity [See also 32Nxx.]
  - 17C40 Exceptional Jordan algebras and associated Lie groups
  - 17C45 Homological methods in Jordan algebras
  - 17C46 Cohomology of Jordan algebras
  - 17C50 Jordan rings associated with other structures [See also 16A68, 17B60.]
  - 17C65 Infinite-dimensional Jordan algebras
  - 17C99 None of the above, but in this section
- 17Dxx Other nonassociative rings and algebras**
  - 17D05 Alternative rings
  - 17D10 Mal'cev rings
  - 17D99 None of the above, but in this section
- 18-XX CATEGORY THEORY, HOMOLOGICAL ALGEBRA**
  - 18-01 Elementary exposition, textbooks
  - 18-02 Advanced exposition (research surveys, monographs, etc.)
  - 18-03 Historical (must also be assigned at least one classification number from Section 01)
  - 18-04 Explicit machine computation and programs (not the theory of computation or programming)
  - 18-06 Proceedings, conferences, etc.
- 18Axx General theory of categories and functors**
  - 18A05 Definitions, generalizations
  - 18A10 Graphs, diagram schemes, precategories, neocategories [See also 20Lxx.]
  - 18A15 Foundations, relations to logic and deductive systems [See also 03-XX.]
  - 18A20 Epimorphisms, monomorphisms, special classes of morphisms, null morphisms, factorization (bicategories)
  - 18A22 Special properties of functors (faithful, full, etc.)
  - 18A23 Natural morphisms, dinatural morphisms
  - 18A25 Functor categories, comma categories
  - 18A30 Limits and colimits (products, sums, directed limits, pushouts, fiber products, equalizers, kernels, ends and coends, etc.)
  - 18A32 Factorization of morphisms (via images, coimages, dominions, codominions), substructures, quotient structures, congruences, amalgams
  - 18A35 Categories admitting limits (complete categories), functors commuting with limits, continuous functors, completions



- 18A40 Adjoint functors (representable functors, universal constructions, reflective subcategories, reflections, etc.), constructions of adjoints (Kan extensions, etc.)
- 18A99 None of the above, but in this section
- 18Bxx Special categories**
- 18B05 Category of sets, characterizations [See also 03–XX.]
- 18B10 Category of relations, additive relations
- 18B15 Imbedding theorems, universal categories [See also 18E20.]
- 18B20 Categories of machines, automata, operative categories [See also 03D05, 68Dxx, 68F10.]
- 18B25 Topoi [See also 03G25.]
- 18B30 Categories of topological spaces and continuous mappings [See also 54–XX.]
- 18B35 Preorders, orders and lattices (viewed as categories) [See also 06–XX.]
- 18B40 Groupoids, semigroupoids, semigroups, groups (viewed as categories) [See also 20Axx, 20Lxx, 20Mxx.]
- 18B99 None of the above, but in this section
- 18Cxx Categories and algebraic theories**
- 18C05 Equational categories [See also 03–XX, 08C05.]
- 18C10 Theories (e.g. algebraic theories), structure, and semantics [See also 03–XX.]
- 18C15 Triples (= standard construction, monad or triad), algebras for a triple, homology and derived functors for triples [See also 18Gxx.]
- 18C20 Algebras and Kleisli categories associated with monads
- 18C99 None of the above, but in this section
- 18Dxx Categories with structure**
- 18D05 Double categories, 2-categories, bicategories, hypercategories
- 18D10 Monoidal categories (= multiplicative categories)
- 18D15 Closed categories (closed monoidal and Cartesian closed categories, etc.)
- 18D20 Enriched categories (over closed or monoidal categories)
- 18D25 Strong functors, strong adjunctions
- 18D30 Fibered categories
- 18D35 Structured objects in a category (group objects, etc.)
- 18D99 None of the above, but in this section
- 18Exx Abelian categories**
- 18E05 Preadditive, additive categories
- 18E10 Exact categories, abelian categories
- 18E15 Grothendieck categories
- 18E20 Imbedding theorems [See also 18B15.]
- 18E25 Derived functors and satellites
- 18E30 Derived categories, triangulated categories
- 18E35 Localization of categories
- 18E40 Torsion theories, radicals [See also 13D30, 16A63.]
- 18E99 None of the above, but in this section
- 18Fxx Categories and geometry**
- 18F05 Local categories and functors
- 18F10 Grothendieck topologies [See also 14F20.]
- 18F15 Abstract manifolds and fiber bundles [See also 55Rxx, 57Pxx.]
- 18F20 Presheaves and sheaves [See also 14F05, 32C35, 32L10, 54B40, 55N30.]
- 18F25 Algebraic  $K$ -theory and  $L$ -theory [See also 10Cxx, 12–XX, 13D15, 14Cxx, 16A54, 57R65, 57R67.]
- 18F30 Grothendieck groups [See also 13D15, 16A54.]
- 18F99 None of the above, but in this section
- 18Gxx Homological algebra [See also 55Uxx.]**
- 18G05 Projectives and injectives [See also 13C10, 13C11, 16A50, 16A52.]
- 18G10 Resolutions; derived functors [See also 18E25.]
- 18G15 Ext and Tor, generalizations, Künneth formula [See also 55U25.]
- 18G20 Homological dimension [See also 13Dxx, 16A60, 16A62.]
- 18G25 Relative homological algebra, projective classes
- 18G30 Simplicial sets, simplicial objects (in a category) [See also 55U10.]
- 18G35 Chain complexes [See also 18E30, 55U15.]
- 18G40 Spectral sequences, hypercohomology [See also 55Txx.]
- 18G50 Nonabelian homological algebra
- 18G55 Nonabelian homotopical algebra
- 18G99 None of the above, but in this section
- 20–XX GROUP THEORY AND GENERALIZATIONS**
- 20–01 Elementary exposition, textbooks
- 20–02 Advanced exposition (research surveys, monographs, etc.)
- 20–03 Historical (must also be assigned at least one classification number from Section 01)
- 20–04 Explicit machine computation and programs (not the theory of computation or programming)
- 20–06 Proceedings, conferences, etc.
- 20Axx Foundations**
- 20A05 Axiomatics and elementary properties
- 20A10 Metamathematical considerations {For word problems, see 20F10.}
- 20A15 Applications of logic to group theory
- 20A99 None of the above, but in this section
- 20Bxx Permutation groups**
- 20B05 General theory for finite groups
- 20B07 General theory for infinite groups
- 20B10 Characterization theorems
- 20B15 Uniprimitive groups
- 20B20 Multiply transitive finite groups
- 20B22 Multiply transitive infinite groups
- 20B25 Finite automorphism groups of algebraic, geometric, or combinatorial structures [See also 05Bxx, 12F10, 20G40, 20H30, 51–XX.]
- 20B27 Infinite automorphism groups [See also 12F10.]
- 20B30 Symmetric groups, general
- 20B35 Subgroups of symmetric groups
- 20B99 None of the above, but in this section
- 20Cxx Representation theory of groups**
- 20C05 Group rings of finite groups and their modules [See also 16A26.]
- 20C07 Group rings of infinite groups and their modules [See also 16A27.]
- 20C10 Integral representations of finite groups
- 20C11  $p$ -adic representations of finite groups
- 20C12 Integral representations of infinite groups
- 20C15 Ordinary representations and characters
- 20C20 Modular representations and characters
- 20C25 Projective representations and multipliers
- 20C30 Representations of finite symmetric groups and other special finite groups
- 20C32 Representations of infinite symmetric groups and other special infinite groups
- 20C35 Applications to physics
- 20C99 None of the above, but in this section
- 20Dxx Abstract finite groups**
- 20D05 Classification of simple and nonsolvable groups
- 20D06 Simple groups: alternating and classical groups [See also 20Gxx, 22Exx.]
- 20D08 Simple groups: sporadic groups
- 20D10 Solvable groups, theory of formations,  $\pi$ -length, ranks, factorable groups,  $p$ -groups
- 20D15 Nilpotent groups,  $p$ -groups
- 20D20 Sylow subgroups, Sylow properties,  $\pi$ -groups,  $\pi$ -structure
- 20D25 Special subgroups (Fratini, Fitting, etc.)
- 20D30 Series and lattices of subgroups
- 20D35 Subnormal subgroups
- 20D40 Products of subgroups
- 20D45 Automorphisms
- 20D50 Covering of subgroups
- 20D60 Arithmetic and combinatorial problems
- 20D99 None of the above, but in this section
- 20Exx Structure and classification of infinite or finite groups**
- 20E05 Free nonabelian groups
- 20E06 Free products, free products with amalgamation, Higman-Neumann-Neumann extensions, and generalizations
- 20E07 Subgroup theorems
- 20E10 Varieties of groups

- 20E15 Chains and lattices of subgroups, subnormal subgroups  
[See also 20F22.]
- 20E18 Limits, profinite groups
- 20E22 Extensions, wreath products, and other compositions
- 20E25 Local properties
- 20E26 Residual properties and generalizations
- 20E28 Maximal subgroups, minimal subgroups
- 20E32 Simple groups [See also 20D05.]
- 20E34 General structure theorems
- 20E36 General theorems concerning automorphisms of groups
- 20E99 None of the above, but in this section
- 20Fxx Special aspects of infinite or finite groups**
- 20F05 Generators, relations, and presentations
- 20F06 Cancellation theory
- 20F10 Word problems, other decision problems, connections with logic and automata [See also 03D05, 03D40, 06B25, 08A50, 68Dxx, 68F10.]
- 20F12 Commutator calculus
- 20F14 Derived series, central series, and generalizations
- 20F16 Solvable groups, supersolvable groups
- 20F18 Nilpotent groups
- 20F19 Generalizations of solvable and nilpotent groups
- 20F22 Other classes of groups defined by subgroup chains
- 20F24 FC-groups and their generalizations
- 20F26 Special subgroups
- 20F28 Automorphism groups of groups [See also 20E36.]
- 20F29 Representations of groups as automorphism groups of algebraic systems
- 20F32 Geometric group theory [See also 05C25, 20Exx, 20Gxx.]
- 20F34 Fundamental groups and their automorphisms [See also 57M05, 57Sxx.]
- 20F36 Braid groups
- 20F38 Other groups related to topology or analysis
- 20F40 Associated Lie structures
- 20F45 Engel conditions
- 20F50 Periodic groups
- 20F60 Ordered groups [See mainly 06F15.]
- 20F99 None of the above, but in this section
- 20Gxx Linear algebraic groups (classical groups) {For arithmetic theory, see 10C30, 10E45; for geometric theory, see 14Lxx, 22Exx; for other methods in representation theory, see 22E45, 22E46, 22E47, 22E50, 22E55.}**
- 20G05 Representation theory
- 20G10 Cohomology theory
- 20G15 Linear algebraic groups over arbitrary fields
- 20G20 Linear algebraic groups over the reals, the complexes, the quaternions
- 20G25 Linear algebraic groups over local fields and their integers
- 20G30 Linear algebraic groups over global fields and their integers
- 20G35 Linear algebraic groups over adèles and other rings and schemes
- 20G40 Linear algebraic groups over finite fields
- 20G45 Applications to physics; explicit representations
- 20G99 None of the above, but in this section
- 20Hxx Other groups of matrices**
- 20H05 Unimodular groups, congruence subgroups [See also 10D07, 22E40, 51F20.]
- 20H10 Fuchsian groups and their generalizations [See also 10D07, 22E40, 30F35, 32Nxx.]
- 20H15 Other geometric groups, including crystallographic groups [See also 51-XX, especially 51F15.]
- 20H20 Other matrix groups over fields
- 20H25 Other matrix groups over rings
- 20H30 Other matrix groups over finite fields
- 20H99 None of the above, but in this section
- 20Jxx Connections with homological algebra and category theory**
- 20J05 Homological methods in group theory
- 20J06 Cohomology of finite groups
- 20J10 Groups arising as cohomology groups
- 20J15 Category of groups
- 20J99 None of the above, but in this section
- 20Kxx Abelian groups**
- 20K01 Finite abelian groups
- 20K05 Finitely generated groups
- 20K10 Torsion groups, primary groups and generalized primary groups
- 20K12 Ulm sequences
- 20K15 Torsion free groups, finite rank
- 20K20 Torsion free groups, infinite rank
- 20K21 Mixed groups
- 20K25 Direct sums, direct products, etc.
- 20K26 Indecomposable groups
- 20K27 Subgroups
- 20K30 Automorphisms, homomorphisms, endomorphisms, etc.
- 20K35 Extensions
- 20K40 Homological and categorical methods
- 20K45 Topological methods
- 20K99 None of the above, but in this section
- 20Lxx Groupoids (small categories in which all morphisms are isomorphisms)**
- 20L05 General theory
- 20L10 Connections with group theory
- 20L13 Mappings of groupoids
- 20L15 Connections with topology
- 20L17 Connections with category theory
- 20L99 None of the above, but in this section
- 20Mxx Semigroups**
- 20M05 Free semigroups, generators and relations, word problem
- 20M07 Varieties of semigroups
- 20M10 General structure theory
- 20M11 Radical theory
- 20M12 Ideal theory
- 20M14 Commutative semigroups
- 20M15 Mappings of semigroups
- 20M20 Semigroups of transformations, etc. [See also 47D05, 47H20, 54H15.]
- 20M25 Semigroup rings, multiplicative semigroups of rings
- 20M30 Representation of semigroups
- 20M35 Semigroups in automata theory, linguistics, etc. [See also 03D05, 68D30, 68Fxx.]
- 20M50 Connections with homological algebra and category theory
- 20M99 None of the above, but in this section
- 20Nxx Other generalizations of groups**
- 20N05 Loops, quasigroups [See also 05Bxx.]
- 20N07 Mappings of loops
- 20N10 Ternary systems (heaps, semiheaps, heapoids, etc.)
- 20N15  $n$ -ary systems
- 20N99 None of the above, but in this section
- 20P05 Probability methods in group theory**
- 22-XX TOPOLOGICAL GROUPS, LIE GROUPS {For transformation groups, see 54H15, 57Sxx, 58-XX. For abstract harmonic analysis, see 43-XX.}**
- 22-01 Elementary exposition, textbooks
- 22-02 Advanced exposition (research surveys, monographs, etc.)
- 22-03 Historical (must also be assigned at least one classification number from Section 01)
- 22-04 Explicit machine computation and programs (not the theory of computation or programming)
- 22-06 Proceedings, conferences, etc.
- 22Axx Topological algebraic systems {For topological rings and fields, see 12Jxx, 13Jxx, 16A80; for dual spaces of operator algebras and topological groups, see 47D35.}**
- 22A05 Structure of general topological groups
- 22A10 Analysis on general topological groups
- 22A15 Structure of topological semigroups
- 22A20 Analysis on topological semigroups
- 22A25 Representations of general topological groups and semigroups
- 22A26 Topological semilattices, lattices and applications [See also 06B30, 06F30.]



- 22A30 Other topological algebraic systems and their representations
- 22A99 None of the above, but in this section
- 22Bxx Locally compact abelian (LCA) groups**
- 22B05 General properties and structure of LCA groups
- 22B10 Structure of group algebras of LCA groups
- 22B99 None of the above, but in this section
- 22C05 Compact groups**
- 22Dxx Locally compact groups and their algebras**
- 22D05 General properties and structure of locally compact groups
- 22D10 Unitary representations of locally compact groups
- 22D12 Other representations of locally compact groups
- 22D15 Group algebras of locally compact groups
- 22D20 Representations of group algebras
- 22D25  $C^*$ -algebras and  $W^*$ -algebras arising from group representations [See also 46Lxx.]
- 22D30 Induced representations
- 22D35 Duality theorems
- 22D40 Ergodic theory on groups [See also 28Dxx and 43A60.]
- 22D45 Automorphism groups of locally compact groups
- 22D99 None of the above, but in this section
- 22Exx Lie groups (For the topology of Lie groups and homogeneous spaces, see 57Sxx, 57Txx; for analysis thereon, see 43A80, 43A85, 43A90.)**
- 22E05 Local Lie groups [See also 34-XX, 35-XX, 58H05.]
- 22E10 General properties and structure of complex Lie groups [See also 32M05.]
- 22E15 General properties and structure of real Lie groups
- 22E20 General properties and structure of other Lie groups
- 22E25 Nilpotent and solvable Lie groups
- 22E27 Representations of nilpotent and solvable Lie groups (special orbital integrals, non-Type I representations, etc.)
- 22E30 Analysis on real and complex Lie groups [See also 33A75, 43-XX.]
- 22E35 Analysis on  $p$ -adic Lie groups [See also 12A85.]
- 22E40 Discrete subgroups of Lie groups [See also 20Hxx and 32Nxx.]
- 22E41 Continuous cohomology [See also 57R32, 57Txx, 58H10.]
- 22E43 Structure and representation of the Lorentz group
- 22E45 Representations of Lie and linear algebraic groups over real fields: analytic methods (For the purely algebraic theory, see 20G05.)
- 22E46 Semi-simple Lie groups and their representations
- 22E47 Representations of Lie and real algebraic groups: algebraic methods (Verma modules, etc.) [See also 17B35.]
- 22E50 Representations of Lie and linear algebraic groups over local fields
- 22E55 Representations of Lie and linear algebraic groups over global fields and adèle rings [See also 20G05.]
- 22E60 Lie algebras of Lie groups (For the algebraic theory of Lie algebras, see 17Bxx.)
- 22E65 Infinite-dimensional Lie groups and their Lie algebras [See also 17B65, 58B25, 58H05.]
- 22E70 Applications of Lie groups to physics; explicit representations [See also 81C40, 81Gxx.]
- 22E99 None of the above, but in this section
- 26-XX REAL FUNCTIONS [See also 54C30.]**
- 26-01 Elementary exposition, textbooks
- 26-02 Advanced exposition (research surveys, monographs, etc.)
- 26-03 Historical (must also be assigned at least one classification number from Section 01)
- 26-04 Explicit machine computation and programs (not the theory of computation or programming)
- 26-06 Proceedings, conferences, etc.
- 26Axx Functions of one variable**
- 26A03 Foundations: limits and generalizations, elementary topology of the line
- 26A06 One-variable calculus
- 26A09 Elementary functions
- 26A12 Rate of growth of functions, orders of infinity, slowly increasing functions [See also 26A48.]
- 26A15 Continuity and related questions (modulus of continuity, semicontinuity, discontinuities, etc.) (For properties determined by Fourier coefficients, see 42A16; for those determined by approximation properties, see 41A25.)
- 26A16 Lipschitz (Hölder) classes
- 26A18 Iteration [See also 39B10, 47H10, 54H25.]
- 26A21 Classification of real functions; Baire classification of sets and functions [See also 04A15, 28A05, 54C50.]
- 26A24 Differentiation (functions of one variable); general theory, generalized derivatives, mean-value theorems [See also 28A15.]
- 26A27 Nondifferentiability (nondifferentiable functions, points of nondifferentiability), discontinuous derivatives
- 26A30 Singular functions, Cantor functions, functions with other special properties
- 26A33 Fractional derivatives and integrals
- 26A36 Antidifferentiation
- 26A39 Denjoy and Perron integrals, other special integrals
- 26A42 Integrals of Riemann, Stieltjes and Lebesgue type [See also 28-XX.]
- 26A45 Functions of bounded variation, generalizations
- 26A46 Absolutely continuous functions
- 26A48 Monotonic functions, generalizations
- 26A51 Convexity, generalizations
- 26A99 None of the above, but in this section
- 26Bxx Functions of several variables**
- 26B05 Continuity and differentiation questions
- 26B10 Implicit function theorems, Jacobians, transformations with several variables
- 26B12 Calculus of vector functions
- 26B15 Integration: length, area, volume [See also 28A75, 51M25.]
- 26B20 Integral formulas (Stokes, Gauss, Green, etc.)
- 26B25 Convexity, generalizations
- 26B30 Absolutely continuous functions, functions of bounded variation
- 26B35 Special properties of functions of several variables, Hölder conditions, etc.
- 26B40 Representation and superposition of functions
- 26B99 None of the above, but in this section
- 26Cxx Polynomials, rational functions**
- 26C05 Polynomials: analytic properties, inequalities, etc.
- 26C10 Polynomials: location of zeros [See also 12D10, 30C15, 65H05.]
- 26C15 Rational functions [See also 14G30.]
- 26C99 None of the above, but in this section
- 26Dxx Inequalities (For maximal function inequalities, see 42B25; for functional inequalities, see 39C05.)**
- 26D05 Inequalities for trigonometric functions and polynomials
- 26D10 Inequalities involving derivatives and differential and integral operators
- 26D15 Inequalities for sums, series and integrals
- 26D20 Other analytical inequalities
- 26D99 None of the above, but in this section
- 26Exx Miscellaneous topics [See also 58Cxx.]**
- 26E05 Real-analytic functions
- 26E10  $C^\infty$ -functions, quasi-analytic functions
- 26E15 Calculus of functions on infinite-dimensional spaces
- 26E20 Calculus of functions taking values in infinite-dimensional spaces
- 26E25 Set-valued functions [See also 54C60.]
- 26E30 Non-Archimedean analysis [See also 12J25.]
- 26E35 Nonstandard analysis [See also 03H05.]
- 26E99 None of the above, but in this section
- 28-XX MEASURE AND INTEGRATION (For analysis on manifolds, see 58-XX.)**
- 28-01 Elementary exposition, textbooks
- 28-02 Advanced exposition (research surveys, monographs, etc.)
- 28-03 Historical (must also be assigned at least one classification number from Section 01)
- 28-04 Explicit machine computation and programs (not the theory of computation or programming)
- 28-06 Proceedings, conferences, etc.

- 28Axx Classical measure theory**
- 28A05 Classes of sets (Borel fields,  $\sigma$ -rings, etc.), measurable sets, Suslin sets, analytic sets [See also 04A15, 26A21, 54H05.]
- 28A10 Real- or complex-valued set functions
- 28A12 Contents, measures, outer measures, capacities
- 28A15 Abstract differentiation theory, differentiation of set functions [See also 26A24.]
- 28A20 Measurable and nonmeasurable functions, sequences of measurable functions, modes of convergence
- 28A25 Integration with respect to measures and other set functions
- 28A33 Spaces of measures, convergence of measures [See also 46E27, 60Bxx.]
- 28A35 Measures and integrals in product spaces
- 28A50 Integration and disintegration of measures
- 28A51 Lifting theory [See also 46G15.]
- 28A60 Measures on Boolean rings, measure algebras [See also 54H10.]
- 28A75 Length, area, volume, other geometric measure theory [See also 26B15, 49F20.]
- 28A99 None of the above, but in this section
- 28Bxx Measures and integrals with values in abstract spaces**
- 28B05 Vector-valued measures and integrals [See also 46G10.]
- 28B10 Group- or semigroup-valued measures and integrals
- 28B15 Measures and integrals with values in general ordered systems
- 28B20 Set-valued measures; integration of set-valued functions; measurable selections [See also 54C60, 54C65.]
- 28B99 None of the above, but in this section
- 28Cxx Measures on spaces with additional structure [See also 46G12, 58C35, 58D20.]**
- 28C05 Integration theory via linear functionals (Radon measures, Daniell integrals, etc.), representing measures
- 28C10 Measures on topological groups, Haar measures, invariant measures [See also 43A05.]
- 28C15 Measures on topological spaces (regularity of measures, etc.)
- 28C20 Measures and integrals in function spaces (Wiener measure, Gauss measure, etc.) [See also 58D20, 60B11.]
- 28C99 None of the above, but in this section
- 28Dxx Measure-theoretic ergodic theory [See also 22D40, 47A35, 54H20, 58Fxx, 60Fxx, 60G10.]**
- 28D05 Measure-preserving transformations
- 28D10 One-parameter continuous families of measure-preserving transformations
- 28D15 General groups of measure-preserving transformations
- 28D20 Entropy and other invariants
- 28D99 None of the above, but in this section
- 30-XX FUNCTIONS OF A COMPLEX VARIABLE (For analysis on manifolds, see 58-XX.)**
- 30-01 Elementary exposition, textbooks
- 30-02 Advanced exposition (research surveys, monographs, etc.)
- 30-03 Historical (must also be assigned at least one classification number from Section 01)
- 30-04 Explicit machine computation and programs (not the theory of computation or programming)
- 30-06 Proceedings, conferences, etc.
- 30Axx General properties**
- 30A05 Monogenic properties of complex functions (including polygenic and areolar monogenic functions)
- 30A10 Inequalities in the complex domain
- 30A99 None of the above, but in this section
- 30Bxx Series expansions**
- 30B10 Power series (including lacunary series)
- 30B20 Random power series
- 30B30 Boundary behavior of power series, over-convergence
- 30B40 Analytic continuation
- 30B50 Dirichlet series and other series expansions, exponential series [See also 40-XX, 41-XX, 42-XX.]
- 30B60 Completeness problems, closure of a system of functions
- 30B70 Continued fractions [See also 10A32, 40A15.]
- 30B99 None of the above, but in this section
- 30Cxx Geometric function theory**
- 30C10 Polynomials
- 30C15 Zeros of polynomials, rational functions, and other analytic functions (e.g. zeros of functions with bounded Dirichlet integral) {For algebraic theory, see 12D10; for real methods, see 26C10.}
- 30C20 Conformal mappings of special domains
- 30C25 Covering theorems in conformal mapping theory
- 30C30 Numerical methods in conformal mapping theory [See also 65E05.]
- 30C35 General theory of conformal mappings
- 30C40 Kernel functions and applications
- 30C45 Special classes of univalent and multivalent functions (star-like, convex, bounded rotation, etc.)
- 30C50 Coefficient problems for univalent and multivalent functions
- 30C55 General theory of univalent and multivalent functions
- 30C60 Quasiconformal mappings
- 30C70 Extremal problems for conformal and quasiconformal mappings, variational methods
- 30C75 Extremal problems for conformal and quasiconformal mappings, other methods
- 30C80 Maximum principle; Schwarz' lemma, Lindelöf principle, analogues and generalizations; subordination
- 30C85 Capacity and harmonic measure in the complex plane [See also 31A15.]
- 30C99 None of the above, but in this section
- 30Dxx Entire and meromorphic functions, and related topics**
- 30D05 Functional equations in the complex domain, iteration and composition of analytic functions [See also 34A20, 39-XX.]
- 30D10 Representations of entire functions by series and integrals
- 30D15 Special classes of entire functions and growth estimates
- 30D20 Entire functions, general theory
- 30D30 Meromorphic functions, general theory
- 30D35 Distribution of values, Nevanlinna theory
- 30D40 Cluster sets, prime ends, boundary behavior
- 30D45 Normal functions, normal families
- 30D50 Blaschke products, bounded characteristic, bounded functions, functions with positive real part
- 30D55  $H^p$ -classes
- 30D60 Quasianalytic and other classes of functions
- 30D99 None of the above, but in this section
- 30Exx Miscellaneous topics of analysis in the complex domain**
- 30E05 Moment problems, interpolation problems
- 30E10 Approximation in the complex domain
- 30E15 Asymptotic representations in the complex domain
- 30E20 Integration, integrals of Cauchy type, integral representations of analytic functions [See also 45Exx.]
- 30E25 Boundary value problems [See also 45Exx.]
- 30E99 None of the above, but in this section
- 30Fxx Riemann surfaces**
- 30F10 Compact Riemann surfaces and uniformization [See also 14H15, 32G15.]
- 30F15 Harmonic functions on Riemann surfaces
- 30F20 Classification theory of Riemann surfaces
- 30F25 Ideal boundary theory
- 30F30 Differentials on Riemann surfaces
- 30F35 Fuchsian groups and automorphic functions [See also 10Dxx, 20H10, 32Gxx, 32Nxx.]
- 30F40 Kleinian groups [See also 20H10.]
- 30F99 None of the above, but in this section
- 30Gxx Generalized function theory**
- 30G05 Non-Archimedean function theory [See also 12J25.]
- 30G10 Nonstandard function theory [See also 03H05.]
- 30G15 Topological function theory
- 30G20 Generalizations of Vekua type (pseudanalytic,  $p$ -analytic, etc.)
- 30G25 Discrete analytic functions
- 30G30 Other generalizations of analytic functions (including abstract-valued functions)



- 30G35 Functions of hypercomplex variables and generalized variables
- 30G99 None of the above, but in this section
- 30H05 Spaces and algebras of analytic functions [See also 32E25, 46Exx, 46J15.]**
- 4-XX POTENTIAL THEORY (For probabilistic potential theory, see 60J45.)**
- 31-01 Elementary exposition, textbooks
- 31-02 Advanced exposition (research surveys, monographs, etc.)
- 31-03 Historical (must also be assigned at least one classification number from Section 01)
- 31-04 Explicit machine computation and programs (not the theory of computation or programming)
- 31-06 Proceedings, conferences, etc.
- 31Axx Two-dimensional theory**
- 31A05 Harmonic, subharmonic, superharmonic functions
- 31A10 Integral representations
- 31A15 Potentials and capacity, harmonic measure, extremal length [See also 30C85.]
- 31A20 Boundary behavior (theorems of Fatou type, etc.)
- 31A25 Boundary value and inverse problems
- 31A30 Biharmonic, polyharmonic functions and equations, Poisson's equation
- 31A35 Connections with differential equations
- 31A99 None of the above, but in this section
- 31Bxx Higher-dimensional theory**
- 31B05 Harmonic, subharmonic, superharmonic functions
- 31B10 Integral representations
- 31B15 Potentials and capacities, extremal length
- 31B20 Boundary value and inverse problems
- 31B25 Boundary behavior
- 31B30 Biharmonic and polyharmonic equations and functions
- 31B35 Connections with differential equations
- 31B99 None of the above, but in this section
- 31Cxx Other generalizations**
- 31C05 Harmonic, subharmonic, superharmonic functions
- 31C10 Pluriharmonic and plurisubharmonic functions [See also 32F05.]
- 31C12 Potential theory on Riemannian manifolds [See also 53C20; for Hodge theory, see 58A14.]
- 31C15 Potentials and capacities
- 31C20 Discrete potential theory and numerical methods
- 31C25 Dirichlet spaces
- 31C99 None of the above, but in this section
- 31D05 Axiomatic potential theory**
- 2-XX SEVERAL COMPLEX VARIABLES AND ANALYTIC SPACES (For infinite-dimensional holomorphy, see also 46G20, 58B12.)**
- 32-01 Elementary exposition, textbooks
- 32-02 Advanced exposition (research surveys, monographs, etc.)
- 32-03 Historical (must also be assigned at least one classification number from Section 01)
- 32-04 Explicit machine computation and programs (not the theory of computation or programming)
- 32-06 Proceedings, conferences, etc.
- 32Axx Holomorphic functions of several complex variables**
- 32A05 Power series, series of functions
- 32A07 Special domains (Reinhardt, Hartogs, tube domains, etc.)
- 32A10 Holomorphic functions
- 32A15 Entire functions
- 32A17 Normal families
- 32A20 Meromorphic functions
- 32A22 Nevanlinna theory: growth estimates (For geometric theory, see 32H25, 32H30.)
- 32A25 Integral representation
- 32A27 Local theory of residues [See also 32C30.]
- 32A30 Other generalizations of function theory of one complex variable (should also be assigned at least one classification number from Section 30) (For functions of several hypercomplex variables, see 30G35.)
- 32A35  $H^p$ -spaces [See also 32M15, 42B30, 43A85, 46J15.]
- 32A40 Boundary behavior
- 32A45 Hyperfunctions [See also 46F15.]
- 32A99 None of the above, but in this section
- 32Bxx Local analytic geometry [See also 13-XX and 14-XX.]**
- 32B05 Analytic algebra and generalizations, preparation theorems
- 32B10 Germs of analytic sets
- 32B15 Analytic subsets of affine space
- 32B20 Semi-analytic sets and subanalytic sets
- 32B25 Triangulation and related questions
- 32B30 Local singularities [See also 14B05, 32C40, 32C42.]
- 32B99 None of the above, but in this section
- 32Cxx General theory of analytic spaces**
- 32C05 Real-analytic manifolds, real-analytic spaces [See also 14G30, 58A07.]
- 32C10 Complex manifolds (For almost complex manifolds, see 53C15.)
- 32C15 Complex spaces
- 32C20 Normal analytic spaces
- 32C25 Analytic subsets and submanifolds
- 32C30 Integration on analytic sets and spaces, currents (For local theory, see 32A25 or 32A27.)
- 32C35 Analytic sheaves and cohomology groups [See also 14Fxx, 18F20, 55N30.]
- 32C36 Local cohomology of analytic spaces
- 32C37 Duality theorems
- 32C40 Singularities
- 32C42 Stratified sets, etc. [See also 32Bxx.]
- 32C45 Modifications, resolution of singularities [See also 14E15.]
- 32C99 None of the above, but in this section
- 32Dxx Analytic continuation**
- 32D05 Domains of holomorphy
- 32D10 Envelopes of holomorphy
- 32D15 Continuation of analytic objects
- 32D20 Removable singularities
- 32D25 Non-Archimedean function theory
- 32D99 None of the above, but in this section
- 32Exx Holomorphic convexity**
- 32E05 Holomorphically convex complex spaces, reduction theory
- 32E10 Stein spaces, Stein manifolds
- 32E15 Runge pairs
- 32E20 Polynomial convexity
- 32E25 Algebras of holomorphic functions [See also 30H05, 46J10, 46J15.]
- 32E27 Krasner-Tate algebras, etc. (algebras of holomorphic functions over non-Archimedean fields)
- 32E30 Holomorphic and polynomial approximation
- 32E35 Global boundary behavior of holomorphic functions
- 32E99 None of the above, but in this section
- 32Fxx Geometric convexity**
- 32F05 Plurisubharmonic functions and generalizations [See also 31C10.]
- 32F10  $q$ -convexity,  $q$ -concavity
- 32F15 Pseudoconvex domains
- 32F20 Geometric results on  $\bar{\partial}$ -Neumann problems [See also 32N15.]
- 32F25 Real submanifolds in complex manifolds
- 32F30 Pseudoconvex manifolds
- 32F99 None of the above, but in this section
- 32Gxx Deformations of analytic structures**
- 32G05 Deformations of complex structures [See also 13D10, 16A58, 58H10, 58H15.]
- 32G07 Deformations of special (e.g. CR) structures
- 32G10 Deformations of submanifolds and subspaces
- 32G11 Deformations of singularities
- 32G13 Analytic moduli problems (For algebraic moduli problems, see 14D20.)
- 32G15 Moduli of Riemann surfaces, Teichmüller theory [See also 14H15, 30Fxx.]
- 32G20 Period matrices [See also 14H05.]
- 32G99 None of the above, but in this section

**32Hxx Holomorphic mappings**

- 32H05 Representative domains
- 32H10 Bergman kernel function
- 32H15 Invariant metrics and pseudodistances
- 32H20 Hyperbolic complex manifolds
- 32H25 Picard type theorems and generalizations (For function-theoretic properties, see 32A22.)
- 32H30 Value distribution theory in higher dimensions (For function-theoretic properties, see 32A22.)
- 32H99 None of the above, but in this section

**32Jxx Compact analytic spaces (For Riemann surfaces, see 14Hxx, 30Fxx.)**

- 32J05 Compactification
- 32J10 Algebraic dependence theorems
- 32J15 Compact surfaces
- 32J20 Algebraicity criteria
- 32J25 Transcendental methods of algebraic geometry [See also 14C30.]
- 32J99 None of the above, but in this section

**32Kxx Generalizations of analytic spaces (should also be assigned at least one other classification number in this section)**

- 32K05 Banach analytic spaces [See also 58Bxx.]
- 32K10 Non-Archimedean analytic spaces
- 32K15 Differentiable functions on analytic spaces, differentiable spaces [See also 58C25.]
- 32K99 None of the above, but in this section

**32Lxx Holomorphic fiber spaces [See also 55Rxx.]**

- 32L05 Holomorphic fiber bundles and generalizations
- 32L10 Sheaves and cohomology of sections of holomorphic vector bundles, general results [See also 18F20, 55N30.]
- 32L15 Bundle convexity [See also 32F10.]
- 32L20 Vanishing theorems
- 32L99 None of the above, but in this section

**32Mxx Complex spaces with a group of automorphisms**

- 32M05 Complex Lie groups, automorphism groups of complex spaces [See also 22E10.]
- 32M10 Homogeneous complex manifolds [See also 14M17, 57T15.]
- 32M15 Hermitian symmetric spaces, bounded symmetric domains [See also 22E10, 22E40, 53C35, 57T15.]
- 32M99 None of the above, but in this section

**32Nxx Automorphic functions [See also 10Dxx, 20H10, 22E40, 30F35.]**

- 32N05 General theory of automorphic functions of several complex variables
- 32N10 Automorphic forms
- 32N15 Automorphic functions in symmetric domains
- 32N99 None of the above, but in this section

**33-XX SPECIAL FUNCTIONS {33-XX deals with the properties of functions as functions. General systems of orthogonal functions are treated in 42C05. Expansions in orthogonal functions are treated in 42C10, 42C15.}**

- 33-01 Elementary exposition, textbooks
- 33-02 Advanced exposition (research surveys, monographs, etc.)
- 33-03 Historical (must also be assigned at least one classification number from Section 01)
- 33-04 Explicit machine computation and programs (not the theory of computation or programming)
- 33-06 Proceedings, conferences, etc.
- 33A10 Exponential and trigonometric functions
- 33A15 Gamma and beta functions
- 33A20 Error function, probability integral
- 33A25 Elliptic functions and integrals
- 33A30 Simple hypergeometric functions of one and several variables
- 33A35 Generalized hypergeometric functions of one and several variables, ( $E$ -functions,  $G$ -functions,  $H$ -functions, etc.)
- 33A40 Cylindrical functions, Bessel functions
- 33A45 Spherical functions (Legendre polynomials and functions, spherical harmonics), ultraspherical polynomials

- 33A50 Gegenbauer functions
- 33A55 Lamé, Mathieu, spheroidal wave functions
- 33A60 Other wave functions
- 33A65 Orthogonal special functions and polynomials (Čebyšev, Hermite, Jacobi, Laguerre, etc.)
- 33A70 Other special functions
- 33A75 Special functions and Lie groups [See also 22Exx, 43A80.]
- 33A99 Miscellaneous topics

**34-XX ORDINARY DIFFERENTIAL EQUATIONS**

- 34-01 Elementary exposition, textbooks
- 34-02 Advanced exposition (research surveys, monographs, etc.)
- 34-03 Historical (must also be assigned at least one classification number from Section 01)
- 34-04 Explicit machine computation and programs (not the theory of computation or programming)
- 34-06 Proceedings, conferences, etc.

**34Axx General theory**

- 34A05 Solutions in closed form, integration by quadratures, reduction of differential equations
- 34A08 Equations not solved with respect to the highest-order derivative, singular solutions
- 34A10 Initial value problems: general existence and uniqueness theorems; continuous dependence of solutions on parameters, initial conditions and boundary conditions [See also 45D05.]
- 34A15 Initial value problems: continuation of solutions
- 34A20 Differential equations in the complex domain [See also 30D05.]
- 34A25 Analytical theory: series, transformations, transforms, operational calculus, etc. [See also 44-XX, 47E05.]
- 34A30 Linear equations and systems
- 34A34 Nonlinear equations and systems, general
- 34A35 Differential equations of infinite order
- 34A40 Differential inequalities
- 34A45 Theoretical approximation of solutions
- 34A50 Numerical approximation of solutions (For numerical analysis, see 65Lxx.)
- 34A55 Inverse problems
- 34A60 Equations with multivalued right-hand sides [See also 49A50, 49E10.]
- 34A99 None of the above, but in this section

**34Bxx Boundary value problems**

- 34B05 Linear equations
- 34B10 Multipoint boundary value problems
- 34B15 Nonlinear boundary value problems
- 34B20 Weyl theory and its generalizations
- 34B25 Spectral theory, Sturm-Liouville, and scattering theory; eigenfunctions, eigenvalues, and expansions [See also 42-XX, 43-XX, 45C05, 47Axx, 47Bxx, 47E05.]
- 34B27 Green functions
- 34B30 Special equations (Mathieu, Hill, Bessel, etc.) [See also 33-XX.]
- 34B99 None of the above, but in this section

**34Cxx Qualitative theory**

- 34C05 Location of integral curves, singular points, limit cycles
- 34C10 Zeros, disconjugacy, oscillation and comparison of solutions
- 34C11 Growth, boundedness of solutions
- 34C15 Nonlinear oscillations
- 34C20 Transformation and reduction of equations and systems
- 34C25 Periodic solutions
- 34C27 Almost-periodic solutions
- 34C28 Other types of "recurrent" solutions
- 34C29 Averaging method [See also 47H10.]
- 34C30 Manifolds of solutions
- 34C35 Dynamical systems [See also 54H20, 58Fxx, 70-XX.]
- 34C40 Equations and systems on manifolds [See mainly 58Fxx, 58Gxx.]
- 34C45 Method of integral manifolds
- 34C50 Method of accelerated convergence
- 34C99 None of the above, but in this section



- 34Dxx Stability theory** [See also 58F10, 93Dxx.]
- 34D05 Asymptotic properties; characteristic exponents
- 34D10 Perturbations
- 34D15 Singular perturbations
- 34D20 Ljapunov stability
- 34D25 Popov-type stability
- 34D30 Structural stability and analogous concepts [See also 58Fxx.]
- 34D40 Ultimate boundedness
- 34D99 None of the above, but in this section
- 34Exx Asymptotic theory**
- 34E05 Asymptotic expansions
- 34E10 Perturbations
- 34E15 Singular perturbations, general theory
- 34E20 Singular perturbations, turning point theory, WKB-methods
- 34E99 None of the above, but in this section
- 34F05 Equations and systems with randomness** [See also 60H10, 93Exx.]
- 34Gxx Differential equations in abstract spaces** [See also 58D25.]
- 34G10 Linear equations [See also 47Axx, 47Bxx, 47D05.]
- 34G20 Nonlinear equations [See also 47Hxx.]
- 34G99 None of the above, but in this section
- 34H05 Control problems** [See also 49-XX, 93-XX.]
- 34Kxx Functional-differential and differential-difference equations, with or without deviating (or retarded) arguments**
- 34K05 General theory
- 34K10 Boundary value problems
- 34K15 Qualitative theory
- 34K20 Stability theory
- 34K25 Asymptotic theory
- 34K30 Equations in abstract spaces
- 34K35 Control problems
- 34K99 None of the above, but in this section
- 5-XX PARTIAL DIFFERENTIAL EQUATIONS**
- 35-01 Elementary exposition, textbooks
- 35-02 Advanced exposition (research surveys, monographs, etc.)
- 35-03 Historical (must also be assigned at least one classification number from Section 01)
- 35-04 Explicit machine computation and programs (not the theory of computation or programming)
- 35-06 Proceedings, conferences, etc.
- 35Axx General theory**
- 35A05 General existence and uniqueness theorems
- 35A07 Local existence and uniqueness theorems [See also 35Hxx, 35Sxx.]
- 35A08 Fundamental solutions
- 35A10 Cauchy-Kowalewski theorems
- 35A15 Variational methods
- 35A20 Analytic methods, singularities
- 35A22 Transform methods
- 35A25 Other special methods
- 35A30 Geometric theory, characteristics, transformations
- 35A35 Theoretical approximation to solutions
- 35A40 Numerical approximation to solutions (For numerical analysis, see 65Mxx, 65Nxx, 65P05.)
- 35A99 None of the above, but in this section
- 35Bxx Qualitative properties of solutions**
- 35B05 Comparison theorems; oscillation, zeros and growth of solutions
- 35B10 Periodic solutions
- 35B15 Almost periodic solutions
- 35B20 Perturbations
- 35B25 Singular perturbations
- 35B30 Dependence of solutions on initial and boundary data, parameters
- 35B32 Bifurcation
- 35B35 Stability, boundedness
- 35B37 Control [See also 49-XX, 93-XX.]
- 35B40 Asymptotic behavior of solutions
- 35B45 A priori estimates
- 35B50 Maximum principles
- 35B60 Continuation and prolongation [See also 58A15, 58A17, 58Hxx.]
- 35B65 Smoothness of solutions
- 35B99 None of the above, but in this section
- 35Cxx Representations of solutions**
- 35C05 Solutions in closed form
- 35C10 Series solutions, expansion theorems
- 35C15 Integral representations
- 35C20 Asymptotic expansions
- 35C99 None of the above, but in this section
- 35Dxx Generalized solutions**
- 35D05 Existence of generalized solutions
- 35D10 Regularity of generalized solutions
- 35D99 None of the above, but in this section
- 35Exx Equations and systems with constant coefficients** [See also 35N05.]
- 35E05 Fundamental solutions
- 35E10 Convexity properties
- 35E15 Initial value problems
- 35E20 General theory
- 35E99 None of the above, but in this section
- 35Fxx General first order equations and systems**
- 35F05 Linear equations and systems, general
- 35F10 Initial value problems for linear equations and systems
- 35F15 Boundary value problems for linear equations and systems
- 35F20 Nonlinear equations and systems, general
- 35F25 Initial value problems for nonlinear equations and systems
- 35F30 Boundary value problems for nonlinear equations and systems
- 35F99 None of the above, but in this section
- 35Gxx General higher order equations and systems**
- 35G05 Linear equations and systems, general
- 35G10 Initial value problems for linear equations and systems
- 35G15 Boundary value problems for linear equations and systems
- 35G20 Nonlinear equations and systems, general
- 35G25 Initial value problems for nonlinear equations and systems
- 35G30 Boundary value problems for nonlinear equations and systems
- 35G99 None of the above, but in this section
- 35H05 Hypoelliptic equations and systems** [See also 58Gxx.]
- 35Jxx Elliptic equations and systems** [See also 58G05, 58G10.]
- 35J05 Laplace equation, reduced wave equation (Helmholtz), Poisson equation
- 35J10 Schrödinger operator [See also 47A40.]
- 35J15 Second order equations, general
- 35J20 Second order equations, variational methods
- 35J25 Second order equations, boundary value problems
- 35J30 Higher order equations, general
- 35J35 Higher order equations, variational methods
- 35J40 Higher order equations, boundary value problems
- 35J45 Systems, general
- 35J50 Systems, variational methods
- 35J55 Systems, boundary value problems
- 35J60 Nonlinear equations and systems
- 35J65 Nonlinear boundary value problems for linear equations and systems; boundary value problems for nonlinear equations and systems
- 35J67 Boundary values of solutions
- 35J70 Equations and systems of degenerate type
- 35J99 None of the above, but in this section
- 35Kxx Parabolic equations and systems** [See also 58G11.]
- 35K05 Heat equation
- 35K10 Second order equations, general
- 35K15 Second order equations, initial value problems
- 35K20 Second order equations, boundary value problems
- 35K22 Evolution equations (any order in the spatial derivatives) [See also 58D25.]
- 35K25 Higher order equations, general
- 35K30 Higher order equations, initial value problems

- 35K35 Higher order equations, boundary value problems  
 35K40 Systems, general  
 35K45 Systems, initial value problems  
 35K50 Systems, boundary value problems  
 35K55 Nonlinear equations and systems  
 35K60 Nonlinear boundary value problems for linear equations and systems; boundary value problems for nonlinear equations and systems  
 35K65 Equations and systems of degenerate type  
 35K70 Ultraparabolic, pseudoparabolic problems  
 35K99 None of the above, but in this section
- 35Lxx Hyperbolic equations and systems [See also 58G16.]**  
 35L05 Wave equation  
 35L10 Second order equations, general  
 35L15 Second order equations, initial value problems  
 35L20 Second order equations, boundary value problems  
 35L25 Higher order equations, general  
 35L30 Higher order equations, initial value problems  
 35L35 Higher order equations, boundary value problems  
 35L40 First order systems, general  
 35L45 First order systems, initial value problems  
 35L50 First order systems, boundary value problems  
 35L55 Higher order hyperbolic systems  
 35L60 First order nonlinear equations and systems  
 35L65 Conservation laws [See also 76-XX.]  
 35L67 Shocks and singularities  
 35L70 Second order nonlinear equations and systems  
 35L75 Higher ( $> 2$ ) order nonlinear equations and systems  
 35L80 Equations and systems of degenerate type  
 35L99 None of the above, but in this section
- 35M05 Equations and systems of mixed (Tricomi, etc.) or composite type (For degenerate types, elliptic, see 35Jxx, parabolic, see 35Kxx, hyperbolic, see 35Lxx, etc.)**
- 35Nxx Overdetermined systems [See also 58G05, 58G07, 58Hxx.]**  
 35N05 Constant coefficients  
 35N10 Variable coefficients, general  
 35N15  $\bar{\partial}$ -Neumann problem and generalizations; formal complexes [See also 32Fxx and 58G05.]  
 35N99 None of the above, but in this section
- 35Pxx Spectral theory and eigenvalue problems [See also 47Axx, 47Bxx, 47F05.]**  
 35P05 General spectral theory  
 35P10 Completeness of eigenfunctions, eigenfunction expansions  
 35P15 Estimation of eigenvalues, upper and lower bounds  
 35P20 Asymptotic distribution of eigenvalues and eigenfunctions  
 35P25 Scattering theory [See also 47A40.]  
 35P30 Nonlinear eigenvalue problems  
 35P99 None of the above, but in this section
- 35Qxx Special equations and problems [See also 35J05, 35K05, 35L05.]**  
 35Q05 Euler-Poisson-Darboux equation and generalizations  
 35Q10 Navier-Stokes equation [See also 76D05.]  
 35Q15 Riemann-Hilbert problems [See also 30E25, 31A25, 31B20.]  
 35Q20 Particular equations of mathematical physics (Korteweg-de Vries, Burgers, etc.)  
 35Q99 None of the above, but in this section
- 35Rxx Miscellaneous topics (For equations on manifolds, see 58Gxx; for manifolds of solutions, see 58Bxx; for stochastic PDEs, see also 60H15.)**  
 35R05 Equations with discontinuous coefficients or data  
 35R10 Difference-partial differential equations, equations with time lag  
 35R15 Equations on function spaces [See also 58D25.]  
 35R20 Operator equations, general [See also 34Gxx, 47A50, 47H15.]  
 35R25 Improperly posed problems  
 35R30 Inverse problems (undetermined coefficients, etc.)  
 35R35 Free boundary problems  
 35R45 Differential inequalities
- 35R60 Equations and systems with randomness  
 35R99 None of the above, but in this section
- 35Sxx Pseudodifferential operators [See also 47G05, 58G15.]**  
 35S05 General theory  
 35S10 Initial value problems  
 35S15 Boundary value problems  
 35S99 None of the above, but in this section
- 39-XX FINITE DIFFERENCES AND FUNCTIONAL EQUATIONS**  
 39-01 Elementary exposition, textbooks  
 39-02 Advanced exposition (research surveys, monographs, etc.)  
 39-03 Historical (must also be assigned at least one classification number from Section 01)  
 39-04 Explicit machine computation and programs (not the theory of computation or programming)  
 39-06 Proceedings, conferences, etc.
- 39Axx Finite differences [See also 65-XX.]**  
 39A05 General  
 39A10 Difference equations  
 39A11 Stability of difference equations  
 39A12 Discrete version of topics in analysis  
 39A70 Difference operators [See also 47B39.]  
 39A99 None of the above, but in this section
- 39Bxx Functional equations [See also 30D05.]**  
 39B05 General  
 39B10 Equations containing iterates, equations of rank one  
 39B20 Equations for one unknown function of one variable, rank greater than one  
 39B30 Equations for several unknown functions of one variable, systems  
 39B40 Equations for functions of several variables  
 39B50 Functional equations on algebraic structures  
 39B60 Matrix functional equations  
 39B70 Functional equations on abstract spaces or structures  
 39B99 None of the above, but in this section
- 39C05 Functional inequalities [See also 26Dxx.]**
- 40-XX SEQUENCES, SERIES, SUMMABILITY**  
 40-01 Elementary exposition, textbooks  
 40-02 Advanced exposition (research surveys, monographs, etc.)  
 40-03 Historical (must also be assigned at least one classification number from Section 01)  
 40-04 Explicit machine computation and programs (not the theory of computation or programming)  
 40-06 Proceedings, conferences, etc.
- 40Axx Convergence and divergence of infinite limiting processes**  
 40A05 Convergence and divergence of series and sequences  
 40A10 Convergence and divergence of integrals  
 40A15 Convergence and divergence of continued fractions [See also 30B70.]  
 40A20 Convergence and divergence of infinite products  
 40A25 Approximation to limiting values (summation of series, etc.) (For the Euler-Maclaurin summation formula, see 65B15.)  
 40A30 Convergence and divergence of series and sequences of functions  
 40A99 None of the above, but in this section
- 40B05 Multiple sequences and series (should also be assigned at least one other classification number in this section)**
- 40Cxx General summability methods**  
 40C05 Matrix methods  
 40C10 Integral methods  
 40C15 Function-theoretic methods (including power series methods and semicontinuous methods)  
 40C99 None of the above, but in this section
- 40Dxx Direct theorems on summability**  
 40D05 General theorems  
 40D09 Structure of summability fields  
 40D10 Tauberian constants and oscillation limits  
 40D15 Convergence factors and summability factors  
 40D20 Summability and bounded fields of methods



- 40D25 Inclusion and equivalence theorems  
 40D99 None of the above, but in this section
- 40Exx Inversion theorems**  
 40E05 Tauberian theorems, general  
 40E10 Growth estimates  
 40E15 Lacunary inversion theorems  
 40E20 Tauberian constants  
 40E99 None of the above, but in this section
- 40F05 Absolute and strong summability**
- 40Gxx Special methods of summability**  
 40G05 Cesàro, Euler, Nörlund and Hausdorff methods  
 40G10 Abel, Borel and power series methods  
 40G99 None of the above, but in this section
- 40H05 Functional analytic methods in summability**
- 40J05 Summability in abstract structures [See also 43A55, 46A35, 46B15.]**
- 1-XX APPROXIMATIONS AND EXPANSIONS (For all approximation theory in the complex domain, see 30E05 and 30E10; for all trigonometric approximation and interpolation, see 42A10 and 42A15; for numerical approximation, see 65Dxx.)**
- 41-01 Elementary exposition, textbooks  
 41-02 Advanced exposition (research surveys, monographs, etc.)  
 41-03 Historical (must also be assigned at least one classification number from Section 01)  
 41-04 Explicit machine computation and programs (not the theory of computation or programming)  
 41-06 Proceedings, conferences, etc.  
 41A05 Interpolation [See also 42A15 and 65D05.]  
 41A10 Approximation by polynomials (For approximation by trigonometric polynomials, see 42A10.)  
 41A15 Spline approximation  
 41A17 Inequalities in approximation (Bernšteĭn, Jackson, Nikol'skiĭ type inequalities)  
 41A20 Approximation by rational functions  
 41A21 Padé approximation  
 41A25 Rate of convergence, degree of approximation  
 41A27 Inverse theorems  
 41A28 Simultaneous approximation  
 41A29 Approximation with constraints  
 41A30 Approximation by other special function classes  
 41A35 Approximation by operators (in particular, by integral operators)  
 41A36 Approximation by positive operators  
 41A40 Saturation  
 41A44 Best constants  
 41A45 Approximation by arbitrary linear expressions  
 41A46 Approximation by arbitrary nonlinear expressions; widths and entropy  
 41A50 Best approximation, including Čebyšev systems  
 41A52 Uniqueness of best approximation  
 41A55 Approximate quadratures  
 41A58 Series expansions (e.g. Taylor, Lidstone series, but not Fourier series)  
 41A60 Asymptotic approximations, asymptotic expansions (steepest descent, etc.) [See also 30E15.]  
 41A63 Multidimensional problems (should also be assigned at least one other classification number in this section)  
 41A65 Abstract approximation theory (approximation in normed linear spaces and other abstract spaces)  
 41A99 Miscellaneous topics
- 2-XX FOURIER ANALYSIS**  
 42-01 Elementary exposition, textbooks  
 42-02 Advanced exposition (research surveys, monographs, etc.)  
 42-03 Historical (must also be assigned at least one classification number from Section 01)  
 42-04 Explicit machine computation and programs (not the theory of computation or programming)  
 42-06 Proceedings, conferences, etc.
- 42Axx Fourier analysis in one variable**  
 42A05 Trigonometric polynomials, inequalities, extremal problems  
 42A10 Trigonometric approximation  
 42A15 Trigonometric interpolation  
 42A16 Fourier coefficients, Fourier series of functions with special properties, special Fourier series  
 42A20 Convergence of Fourier and trigonometric series  
 42A24 Summability of Fourier and trigonometric series  
 42A28 Absolute convergence, absolute summability  
 42A32 Trigonometric series of special types (positive coefficients, monotonic coefficients, etc.)  
 42A38 Fourier and Fourier-Stieltjes transforms and other transforms of Fourier type  
 42A45 Multipliers  
 42A50 Conjugate functions, conjugate series, singular integrals  
 42A55 Lacunary series of trigonometric and other functions; Riesz products  
 42A61 Probabilistic methods  
 42A63 Uniqueness of trigonometric expansions, uniqueness of Fourier expansions, Riemann theory, localization  
 42A65 Completeness of sets of functions  
 42A70 Trigonometric moment problems  
 42A75 Classical almost periodic functions, mean periodic functions [See also 43A60.]  
 42A82 Positive definite functions  
 42A85 Convolution, factorization  
 42A99 None of the above, but in this section
- 42Bxx Fourier analysis in several variables**  
 42B05 Fourier series and coefficients  
 42B10 Fourier and Fourier-Stieltjes transforms and other transforms of Fourier type  
 42B15 Multipliers  
 42B20 Singular integrals (Calderón-Zygmund, etc.)  
 42B25 Maximal functions, Littlewood-Paley theory  
 42B30  $H^p$ -spaces  
 42B99 None of the above, but in this section
- 42Cxx Nontrigonometric Fourier analysis**  
 42C05 Orthogonal functions and polynomials, general theory [See also 33A65.]  
 42C10 Fourier series in special orthogonal functions (Legendre polynomials, Walsh functions, etc.)  
 42C15 Series of general orthogonal functions, generalized Fourier expansions, nonorthogonal expansions  
 42C20 Rearrangements and other transformations of Fourier and other orthogonal series  
 42C25 Uniqueness and localization for orthogonal series  
 42C30 Completeness of sets of functions  
 42C99 None of the above, but in this section
- 43-XX ABSTRACT HARMONIC ANALYSIS (For other analysis on topological and Lie groups, see 22Exx.)**  
 43-01 Elementary exposition, textbooks  
 43-02 Advanced exposition (research surveys, monographs, etc.)  
 43-03 Historical (must also be assigned at least one classification number from Section 01)  
 43-04 Explicit machine computation and programs (not the theory of computation or programming)  
 43-06 Proceedings, conferences, etc.  
 43A05 Measures on groups, semigroups, etc.  
 43A07 Means on groups, semigroups, etc.  
 43A10 Measure algebras on groups, semigroups, etc.  
 43A15  $L^p$ -spaces and other function spaces on groups, semigroups, etc.  
 43A17 Analysis on ordered groups,  $H^p$ -theory  
 43A20  $L^1$ -algebras on groups, semigroups, etc.  
 43A22 Homomorphisms and multipliers of function spaces on groups, semigroups, etc.  
 43A25 Fourier and Fourier-Stieltjes transforms on locally compact abelian groups  
 43A30 Fourier and Fourier-Stieltjes transforms on nonabelian groups and on semigroups, etc.  
 43A32 Other transforms and operators of Fourier type  
 43A35 Positive definite functions on groups, semigroups, etc.

- 43A40 Character groups and dual objects
- 43A45 Spectral synthesis on groups, semigroups, etc.
- 43A46 Special sets (thin sets, Kronecker sets, Helson sets, Ditkin sets, Sidon sets, etc.)
- 43A50 Convergence of Fourier series and of inverse transforms
- 43A55 Summability methods on groups, semigroups, etc. [See also 40J05.]
- 43A60 Almost periodic functions on groups and semigroups and their generalizations (recurrent functions, distal functions, etc.); almost automorphic functions
- 43A65 Representations of groups, semigroups, etc. [See also 22Dxx.]
- 43A70 Analysis on specific locally compact abelian groups [See also 12A85.]
- 43A75 Analysis on specific compact groups
- 43A77 Analysis on general compact groups
- 43A80 Analysis on other specific Lie groups [See also 22E30.]
- 43A85 Analysis on homogeneous spaces
- 43A90 Spherical functions [See also 22E45, 22E46.]
- 43A95 Categorical methods [See also 18—XX, 46Mxx.]
- 43A99 Miscellaneous topics

**44—XX INTEGRAL TRANSFORMS, OPERATIONAL CALCULUS {For fractional derivatives and integrals, see 26A33, For numerical methods, see 65R10.}**

- 44-01 Elementary exposition, textbooks
- 44-02 Advanced exposition (research surveys, monographs, etc.)
- 44-03 Historical (must also be assigned at least one classification number from Section 01)
- 44-04 Explicit machine computation and programs (not the theory of computation or programming)
- 44-06 Proceedings, conferences, etc.
- 44A05 General transforms [See also 42A38.]
- 44A10 Laplace transform
- 44A15 Special transforms (Legendre, Hilbert, etc.)
- 44A20 Transforms of special functions
- 44A30 Multiple transforms
- 44A35 Convolution
- 44A40 Calculus of Mikusiński and other similar operational calculi
- 44A45 Classical operational calculus
- 44A55 Discrete operational calculus
- 44A60 Moment problems
- 44A99 Miscellaneous topics

**45—XX INTEGRAL EQUATIONS**

- 45-01 Elementary exposition, textbooks
- 45-02 Advanced exposition (research surveys, monographs, etc.)
- 45-03 Historical (must also be assigned at least one classification number from Section 01)
- 45-04 Explicit machine computation and programs (not the theory of computation or programming)
- 45-06 Proceedings, conferences, etc.
- 45A05 Linear integral equations
- 45B05 Fredholm integral equations
- 45C05 Eigenvalue problems [See also 34B25, 35Pxx, 45P05.]
- 45D05 Volterra integral equations [See also 34A10.]
- 45Exx Singular integral equations [See also 30E20, 30E25, 44A15, 44A35.]
- 45E05 Integral equations with kernels of Cauchy type [See also 35J15.]
- 45E10 Integral equations of the convolution type (Abel, Picard, Toeplitz and Wiener-Hopf type) [See also 47B35.]
- 45E99 None of the above, but in this section
- 45Fxx Systems of linear integral equations
- 45F05 Systems of nonsingular linear integral equations
- 45F10 Dual, triple, etc., integral and series equations
- 45F15 Systems of singular linear integral equations
- 45F99 None of the above, but in this section
- 45Gxx Nonlinear integral equations [See also 47Hxx.]
- 45G05 Singular nonlinear integral equations
- 45G10 Other nonlinear integral equations

**45H05 Miscellaneous special kernels [See also 44A15.]**

**45J05 Integro-ordinary differential equations**

**45K05 Integro-partial differential equations**

**45Lxx Approximation of solutions**

45L05 Theoretical approximation of solutions

45L10 Numerical approximation of solutions (For numerical analysis, see 65R20.)

45L99 None of the above, but in this section

**45Mxx Qualitative behavior**

45M05 Asymptotics

45M10 Stability theory

45M99 None of the above, but in this section

**45N05 Abstract integral equations, integral equations in abstract spaces**

**45P05 Integral operators [See also 47Axx, 47Bxx, 47G05.]**

**46—XX FUNCTIONAL ANALYSIS {For manifolds modeled on topological linear spaces, see 57N20, 58Bxx.}**

46-01 Elementary exposition, textbooks

46-02 Advanced exposition (research surveys, monographs, etc.)

46-03 Historical (must also be assigned at least one classification number from Section 01)

46-04 Explicit machine computation and programs (not the theory of computation or programming)

46-06 Proceedings, conferences, etc.

**46Axx Topological linear spaces**

46A05 Locally convex spaces

46A06 Metrizable topological linear spaces and their duals (F-, DF-spaces, etc.)

46A07 Barrelled spaces

46A09 Bornological spaces

46A10 Locally bounded topological linear spaces

46A12 Spaces defined by special inductive or projective limits (LF-, nuclear, Schwartz, Silva spaces, etc.) [See also 46M10, 46M40.]

46A14 Spaces defined by compactness properties (Montel spaces, etc.)

46A15 Other topological linear spaces

46A20 Duality theory

46A22 Extension and lifting of functionals and operators [See also 46M10.]

46A25 Reflexivity and semi-reflexivity

46A30 Open mappings and closed graph theorems and completeness (including  $B_*$ ,  $B_r$ -completeness)

46A32 Spaces of linear operators

46A35 Summability and bases

46A40 Ordered topological linear spaces, vector lattices [See also 06F20, 46B30.]

46A45 Sequence spaces (including Köthe sequence spaces)

46A50 Compactness in topological linear spaces

46A55 Convexity, Choquet theory [See also 52A07.]

46A99 None of the above, but in this section

**46Bxx Normed linear spaces and Banach spaces {For function spaces, see 46Exx.}**

46B05 Topology in terms of the norms

46B10 Duality and reflexivity

46B15 Summability and bases

46B20 Geometry and structure

46B22 Spaces with Radon-Nikodým property [See also 46G10.]

46B25 Classical Banach spaces in the general theory

46B30 Banach lattices [See also 46A40.]

46B99 None of the above, but in this section

**46Cxx Inner product spaces, Hilbert spaces {For function spaces, see 46Exx.}**

46C05 Geometry and topology of the spaces

46C10 Other properties of such spaces

46C99 None of the above, but in this section

**46D05 Spaces with indefinite inner product**

**46Exx Linear function spaces and their duals [See also 30H05; for function algebras, see 46J10.]**

46E05 Lattices of continuous, differentiable or analytic functions



- 46E10 Topological linear spaces of continuous, differentiable or analytic functions
- 46E15 Banach spaces of continuous, differentiable or analytic functions
- 46E20 Hilbert spaces of continuous, differentiable or analytic functions
- 46E25 Rings and algebras of continuous, differentiable or analytic functions {For Banach function algebras, see 46J10, 46J15.}
- 46E27 Spaces of measures [See also 28A33.]
- 46E30 Spaces of measurable functions ( $L^p$ -spaces, Orlicz spaces, Köthe function spaces, Lorentz spaces, rearrangement invariant spaces, etc.)
- 46E35 Sobolev spaces and other spaces of "smooth" functions, imbedding theorems, trace theorems
- 46E39 Sobolev (and similar kinds of) spaces of functions of discrete variables
- 46E40 Spaces of vector- and operator-valued functions
- 46E99 None of the above, but in this section
- 46Fxx Distributions, generalized functions, distribution spaces {For distribution theory on nonlinear spaces, see 58Cxx.}**
- 46F05 Topological linear spaces of test functions and distributions
- 46F10 Operations with distributions
- 46F12 Integral transforms in distribution spaces [See also 42-XX, 44-XX.]
- 46F15 Hyperfunctions, analytic functionals [See also 32A25, 32A45, 32C35, 58G07.]
- 46F20 Distributions as boundary values of analytic functions [See also 30Exx, 32A40.]
- 46F25 Distributions on infinite-dimensional spaces [See also 58C35.]
- 46F99 None of the above, but in this section
- 46Gxx Measures, integration, derivative {For integration on infinite-dimensional spaces, see 28C20; for nonlinear functional analysis, see 58-XX, especially 58Cxx.}**
- 46G05 Derivatives
- 46G10 Vector-valued measures and integration [See also 28Bxx, 46B22.]
- 46G12 Measures and integration on abstract linear spaces [See also 28Cxx.]
- 46G15 Lifting theory [See also 28A51.]
- 46G20 Infinite-dimensional holomorphy [See also 32-XX, 58B12, 58C10.]
- 46G99 None of the above, but in this section
- 46Hxx Topological algebras, normed rings and algebras, Banach algebras {For group algebras, convolution algebras and measure algebras, see 43-XX.}**
- 46H05 General theory
- 46H10 Ideals and subalgebras
- 46H15 Representations
- 46H20 Structure, classification
- 46H25 Normed modules and Banach modules, topological modules (if not placed in 13-XX or 16-XX)
- 46H30 Functional calculus [See also 47A60.]
- 46H99 None of the above, but in this section
- 46Jxx Commutative Banach algebras and commutative topological algebras**
- 46J05 General theory
- 46J10 Banach algebras of continuous functions, function algebras
- 46J15 Banach algebras of differentiable or analytic functions,  $H^p$ -spaces [See also 30A98, 32A35, 32E25, 42B30.]
- 46J20 Ideals, maximal ideals, boundaries
- 46J25 Representations
- 46J30 Subalgebras
- 46J35 Structure, classification
- 46J99 None of the above, but in this section
- 46Kxx Rings and algebras with an involution**
- 46K05 General theory
- 46K10 Representations
- 46K15 Hilbert algebras
- 46K99 None of the above, but in this section
- 46Lxx  $C^*$ -algebras and von Neumann ( $W^*$ -) algebras [See also 22D25.]**
- 46L05  $C^*$ -algebras, general theory
- 46L10 von Neumann algebras, general theory
- 46L30 States
- 46L35 Classifications, factors
- 46L40 Automorphisms
- 46L45 Decomposition theory
- 46L50 Noncommutative integration, noncommutative probability
- 46L55 Noncommutative dynamical systems [See also 28Dxx.]
- 46L60 Applications to physics
- 46L99 None of the above, but in this section
- 46Mxx Categorical methods [See also 18-XX.]**
- 46M05 Tensor products
- 46M10 Projective and injective objects
- 46M15 Functors
- 46M20 Methods of algebraic topology (cohomology, sheaf and bundle theory, etc.) [See also 14F05, 18Fxx, 55Rxx.]
- 46M35 Abstract interpolation of topological vector spaces
- 46M40 Inductive and projective limits [See also 46A12.]
- 46M99 None of the above, but in this section
- 46N05 Miscellaneous applications of functional analysis**
- 46P05 Functional analysis over fields other than  $\mathbb{R}$  or  $\mathbb{C}$ ; non-Archimedean functional analysis [See also 12J25, 32E27.]**
- 47-XX OPERATOR THEORY**
- 47-01 Elementary exposition, textbooks
- 47-02 Advanced exposition (research surveys, monographs, etc.)
- 47-03 Historical (must also be assigned at least one classification number from Section 01)
- 47-04 Explicit machine computation and programs (not the theory of computation or programming)
- 47-06 Proceedings, conferences, etc.
- 47Axx Single linear operators: general theory**
- 47A05 General (adjoints, conjugates, products, inverses, domains, ranges, etc.)
- 47A10 Spectrum, resolvent
- 47A12 Numerical range
- 47A15 Invariant subspaces
- 47A20 Dilations, extensions, compressions
- 47A25 Spectral sets
- 47A30 Norms (inequalities, more than one norm, etc.)
- 47A35 Ergodic theory [See also 28Dxx.]
- 47A40 Scattering theory [See also 34B25, 35P25, 47Dxx.]
- 47A45 Canonical models for contractions and nonselfadjoint operators
- 47A50 Equations involving linear operators, with vector unknowns
- 47A53 Fredholm operators
- 47A55 Perturbation theory
- 47A60 Functional calculus
- 47A62 Equations involving linear operators, with operator unknowns
- 47A65 Structure theory
- 47A66 (Non)quasitriangular, (non)quasidiagonal operators
- 47A67 Representation theory
- 47A68 Factorization theory
- 47A70 Eigenfunction expansions, rigged Hilbert spaces; eigenvalue problems in general [See also 49Gxx.]
- 47A99 None of the above, but in this section
- 47Bxx Single linear operators: special classes of operators**
- 47B05 Compact operators, Riesz operators
- 47B10 Hilbert-Schmidt operators, trace class operators, nuclear operators,  $p$ -summing operators, etc.
- 47B15 Hermitian and normal operators (spectral measures, functional calculus, etc.)
- 47B20 Subnormal operators, hyponormal operators, etc.
- 47B25 Symmetric and selfadjoint operators (unbounded)
- 47B35 Toeplitz operators, Wiener-Hopf operators [See also 45P05, 47G05 for other integral operators.]

- 47B37 Operators on special spaces (weighted shifts, operators on sequence spaces, etc.)
- 47B38 Operators on function spaces
- 47B39 Difference operators [See also 39A70.]
- 47B40 Spectral operators, decomposable operators, etc.
- 47B44 Accretive operators, dissipative operators, etc.
- 47B47 Commutators, derivations
- 47B50 Operators on a space with an indefinite metric
- 47B55 Operators on ordered spaces
- 47B99 None of the above, but in this section
- 47Cxx Single linear operators as elements of algebraic systems**
  - 47C05 Operators in algebras
  - 47C10 Operators in \*-algebras
  - 47C15 Operators in  $C^*$ - or von Neumann algebras
  - 47C99 None of the above, but in this section
- 47Dxx Algebraic systems of linear operators [See also 46Lxx.]**
  - 47D05 Semigroups of operators {For nonlinear operators, see 47H20; see also 20M20.}
  - 47D07 Markov semigroups {For Markov processes, see 60Jxx.}
  - 47D10 Groups of operators
  - 47D15 Linear spaces of operators
  - 47D20 Convex sets and cones of operators
  - 47D25 Operator algebras and ideals, on Hilbert space
  - 47D30 Operator algebras and ideals, on Banach spaces and other linear topological spaces
  - 47D35 Dual spaces of operator algebras and topological groups
  - 47D40 Algebras of unbounded operators
  - 47D45 Applications to physics
  - 47D99 None of the above, but in this section
- 47E05 Ordinary differential operators [See also 34B25, 58Fxx.]**
- 47F05 Partial differential operators [See also 35Pxx, 58Gxx.]**
- 47G05 Integral, integro-differential, and pseudodifferential operators [See also 35Sxx, 45P05, 58Gxx.]**
- 47Hxx Nonlinear operators {For global and geometric aspects, see 58-XX, especially 58Cxx.}**
  - 47H05 Monotone operators
  - 47H06 Accretive operators, dissipative operators, etc.
  - 47H07 Monotone and positive operators on ordered Banach spaces or other ordered topological vector spaces
  - 47H09 Nonexpansive mappings, ultimately compact mappings,  $K$ -set contractions, etc.
  - 47H10 Fixed-point theorems [See also 34C29, 54H25, 55M20, 58C30.]
  - 47H12 Spectral theory of nonlinear operators
  - 47H15 Equations involving nonlinear operators [See also 58E07 for abstract bifurcation theory.]
  - 47H17 Methods for solving equations involving nonlinear operators {For numerical analysis, see 65J15.}
  - 47H20 Semigroups of nonlinear operators [See also 58D07.]
  - 47H99 None of the above, but in this section
- 49-XX CALCULUS OF VARIATIONS AND OPTIMAL CONTROL; OPTIMIZATION [See also 34H05, 65Kxx, 90Cxx, 93-XX.]**
  - 49-01 Elementary exposition, textbooks
  - 49-02 Advanced exposition (research surveys, monographs, etc.)
  - 49-03 Historical (must also be assigned at least one classification number from Section 01)
  - 49-04 Explicit machine computation and programs (not the theory of computation or programming)
  - 49-06 Proceedings, conferences, etc.
- 49Axx Existence theory for optimal solutions**
  - 49A05 Free problems in one independent variable
  - 49A10 Problems involving ordinary differential equations, optimal control
  - 49A21 Free problems in two or more independent variables
  - 49A22 Problems involving partial differential equations, optimal control
  - 49A27 Problems in abstract spaces
  - 49A29 Variational inequalities
- 49A34 Problems involving functional relations other than differential equations
- 49A36 Optimal solutions belonging to restricted classes (bang-bang controls, etc.)
- 49A40 Minimax problems
- 49A45 Game theory; pursuit and evasion [See also 90Dxx.]
- 49A50 Topology of solutions, weak and strong minima, semicontinuity, convexity, orior fields
- 49A51 Fréchet and Gâteaux differentiability
- 49A55 Duality theory
- 49A60 Optimal stochastic control [See also 93Exx.]
- 49A99 None of the above, but in this section
- 49Bxx Necessary conditions and sufficient conditions for optimality**
  - 49B05 Free problems in one independent variable
  - 49B10 Problems involving ordinary differential equations, optimal control
  - 49B21 Free problems in two or more independent variables
  - 49B22 Problems involving partial differential equations, optimal control
  - 49B27 Problems in abstract spaces
  - 49B34 Problems involving functional relations other than differential equations
  - 49B36 Optimal solutions belonging to restricted classes
  - 49B40 Minimax problems
  - 49B50 Sensitivity of optimal solutions in the presence of perturbations
  - 49B60 Optimal stochastic control [See also 93Exx.]
  - 49B99 None of the above, but in this section
- 49Cxx Carathéodory, Hamilton-Jacobi theories, including dynamic programming [See also 90C39.]**
  - 49C05 Free problems and problems involving ordinary differential equations
  - 49C10 Free problems and problems involving partial differential equations
  - 49C15 Problems in abstract spaces or involving functional relations other than differential equations
  - 49C20 Dynamic programming method
  - 49C99 None of the above, but in this section
- 49Dxx Methods of successive approximations {For discrete problems, see 90Cxx; see also 65Kxx.}**
  - 49D05 Methods based on necessary conditions
  - 49D07 Gradient methods
  - 49D10 Methods of steepest descent type
  - 49D15 Methods of Newton-Raphson, Galerkin and Ritz types
  - 49D20 Methods of relaxation type
  - 49D25 Finite difference methods
  - 49D27 Decomposition methods
  - 49D29 Multiplier methods
  - 49D30 Other methods, not based on necessary conditions (penalty function, etc.)
  - 49D35 Methods of linear programming type
  - 49D37 Nonlinear programming
  - 49D39 Semi-infinite programming
  - 49D40 Methods of quadratic programming type
  - 49D45 Methods of convex programming type
  - 49D49 Geometric programming
  - 49D50 Periodic optimization
  - 49D99 None of the above, but in this section
- 49Exx Controllability and geometry of control problems**
  - 49E05 General dependence on controls
  - 49E10 Orior fields (contingency equations)
  - 49E15 Attainable sets, controllability
  - 49E20 Interrelations between stability problems and optimization problems
  - 49E25 Effect of perturbations on controllability
  - 49E30 Relations between controllability and optimal solutions
  - 49E99 None of the above, but in this section
- 49Fxx Manifolds [See also 58Exx.]**
  - 49F05 Exterior differential forms, invariant integrals (Cartan theory) [See mainly 58A15.]
  - 49F10 Minimal surfaces [See mainly 53A10, also 58E12.]



- 49F15 Morse theory in Hilbert and other spaces [See also 57R27, 58Exx.]
- 49F20 Geometric measure and integration theory, integral and normal currents, flat chains and cochains, varifolds [See also 28A75, 32C30, 58A25, 58C35.]
- 49F22 Existence and structure of solutions to variational problems in geometric measure-theoretic setting
- 49F25 Surface area; Weierstrass and Burkill integrals, subadditive set functions
- 49F99 None of the above, but in this section
- 49Gxx Variational methods for eigenvalues [See also 47A70.]**
- 49G05 Variational approach to eigenvalues
- 49G10 Rayleigh-Ritz methods
- 49G15 Weinstein and Aronszajn methods, intermediate problems
- 49G20 Linear operators in Hilbert spaces
- 49G99 None of the above, but in this section
- 49H05 Variational principles of physics [See also 70-XX, 81-XX.]**
- 51-XX GEOMETRY {For algebraic geometry, see 14-XX.}**
- 51-01 Elementary exposition, textbooks
- 51-02 Advanced exposition (research surveys, monographs, etc.)
- 51-03 Historical (must also be assigned at least one classification number from Section 01)
- 51-04 Explicit machine computation and programs (not the theory of computation or programming)
- 51-06 Proceedings, conferences, etc.
- 51Axx Linear incidence geometry**
- 51A05 General theory and projective geometries
- 51A10 Homomorphism, automorphism and dualities
- 51A15 Structures with parallelism
- 51A20 Configuration theorems
- 51A25 Algebraization [See also 12Kxx, 20N10.]
- 51A30 Desarguesian and Pappian geometries
- 51A35 Non-Desarguesian affine and projective planes
- 51A40 Translation planes and spreads
- 51A45 Incidence structures imbeddable into projective geometries
- 51A99 None of the above, but in this section
- 51Bxx Nonlinear incidence geometry**
- 51B05 General theory
- 51B10 Möbius geometries
- 51B15 Laguerre geometries
- 51B20 Minkowski geometries
- 51B25 Lie geometries
- 51B99 None of the above, but in this section
- 51C05 Ring geometry (Hjelmslev, Barbilian, etc.)**
- 51Dxx Geometric closure systems**
- 51D05 Abstract (Maeda) geometries
- 51D10 Abstract geometries with exchange axiom
- 51D15 Abstract geometries with parallelism
- 51D20 Combinatorial geometries [See also 05B25.]
- 51D25 Lattices of subspaces [See also 05B35.]
- 51D30 Continuous geometries and related topics
- 51D99 None of the above, but in this section
- 51Exx Finite geometry**
- 51E05 General block designs [See also 05B05.]
- 51E10 Steiner systems
- 51E15 Affine and projective planes
- 51E20 Combinatorial structures in finite projective spaces [See also 05Bxx.]
- 51E25 Finite nonlinear geometries
- 51E30 Other finite incidence structures [See also 05B30.]
- 51E99 None of the above, but in this section
- 51Fxx Metric geometry**
- 51F05 Absolute planes
- 51F10 Absolute spaces
- 51F15 Reflection groups, reflection geometries [See also 20H10, 20H15.]
- 51F20 Congruence and orthogonality [See also 20H05.]
- 51F25 Orthogonal and unitary groups [See also 20H05.]
- 51F99 None of the above, but in this section
- 51G05 Ordered geometries (ordered incidence structures, etc.)**
- 51Hxx Topological geometry**
- 51H05 General theory
- 51H10 Topological linear incidence structures
- 51H15 Topological nonlinear incidence structures
- 51H20 Topological geometries on manifolds [See also 57-XX.]
- 51H25 Geometries with differentiable structure [See also 53Cxx, 53C70.]
- 51H30 Geometries with algebraic manifold structure [See also 14-XX.]
- 51H99 None of the above, but in this section
- 51Jxx Incidence groups**
- 51J05 General theory
- 51J10 Projective incidence groups
- 51J15 Kinematic spaces
- 51J20 Representation by near-fields and near-algebras [See also 12K05, 16A76.]
- 51J99 None of the above, but in this section
- 51Kxx Distance geometry**
- 51K05 General theory
- 51K10 Synthetic differential geometry
- 51K99 None of the above, but in this section
- 51Lxx Geometric order structures [See also 53C75.]**
- 51L05 Geometry of orders of nondifferentiable curves
- 51L10 Directly differentiable curves
- 51L15  $n$ -vertex theorems via direct methods
- 51L20 Geometry of orders of surfaces
- 51L99 None of the above, but in this section
- 51Mxx Real and complex geometry**
- 51M05 Euclidean geometries
- 51M10 Hyperbolic and elliptic geometries
- 51M15 Geometric constructions
- 51M20 Polyhedra and polytopes; regular figures, division of spaces [See also 51F15.]
- 51M25 Length, area and volume [See also 26B15.]
- 51M30 Line geometries and their generalizations
- 51M35 Synthetic treatment of fundamental manifolds in projective geometries (Grassmannians, Veronesians and their generalizations) [See also 14M15.]
- 51M99 None of the above, but in this section
- 51Nxx Analytic and descriptive geometry**
- 51N05 Descriptive geometry
- 51N10 Affine analytic geometry
- 51N15 Projective analytic geometry
- 51N20 Euclidean analytic geometry
- 51N25 Analytic geometry with other transformation groups
- 51N30 Geometry of classical groups [See also 20Gxx, 14Lxx.]
- 51N35 Questions of classical algebraic geometry [See also 14Nxx.]
- 51N99 None of the above, but in this section
- 52-XX CONVEX SETS AND RELATED GEOMETRIC TOPICS**
- 52-01 Elementary exposition, textbooks
- 52-02 Advanced exposition (research surveys, monographs, etc.)
- 52-03 Historical (must also be assigned at least one classification number from Section 01)
- 52-04 Explicit machine computation and programs (not the theory of computation or programming)
- 52-06 Proceedings, conferences, etc.
- 52A01 Axiomatic and generalized convexity
- 52A05 Convex sets without dimension restrictions
- 52A07 Convex sets in topological vector spaces [See also 46A55.]
- 52A10 Convex sets in 2 dimensions
- 52A15 Convex sets in 3 dimensions
- 52A20 Convex sets in  $n$  dimensions
- 52A22 Random convex sets and integral geometry [See also 53C65, 60D05.]
- 52A25 Polyhedra and polytopes
- 52A30 Invariants of convex sets (star-shaped,  $(m, n)$ -convex, etc.)
- 52A35 Helly type theorems
- 52A37 Other problems of combinatorial geometry
- 52A40 Inequalities and extremum problems
- 52A43 Lattices and convex bodies [See also 10E05.]

- 52A45 Packing, covering, tiling [See also 05B40, 05B45, 10E30, 51-XX.]
- 52A50 Hilbert geometry [See also 51Kxx.]
- 52A55 Spherical and hyperbolic convexity
- 52A99 Miscellaneous topics

**53-XX DIFFERENTIAL GEOMETRY {For differential topology, see 57Rxx. For foundational questions of differentiable manifolds, see 58Axx.}**

- 53-01 Elementary exposition, textbooks
- 53-02 Advanced exposition (research surveys, monographs, etc.)
- 53-03 Historical (must also be assigned at least one classification number from Section 01)
- 53-04 Explicit machine computation and programs (not the theory of computation or programming)
- 53-06 Proceedings, conferences, etc.
- 53Axx Classical differential geometry**
  - 53A04 Curves in Euclidean space
  - 53A05 Surfaces in Euclidean space
  - 53A07 Higher-dimension and -codimension surfaces in Euclidean  $n$ -space
  - 53A10 Minimal surfaces, surfaces with prescribed mean curvature [See also 49F10, 53C42.]
  - 53A15 Affine differential geometry
  - 53A17 Kinematics
  - 53A20 Projective differential geometry
  - 53A25 Differential line geometry
  - 53A30 Conformal differential geometry
  - 53A35 Non-Euclidean differential geometry
  - 53A40 Other special differential geometries
  - 53A45 Vector and tensor analysis
  - 53A50 Spinor analysis
  - 53A55 Differential invariants (local theory), geometric objects
  - 53A60 Geometry of webs [See also 14C21, 20N05.]
  - 53A99 None of the above, but in this section
- 53Bxx Local differential geometry**
  - 53B05 Linear and affine connections
  - 53B10 Projective connections
  - 53B15 Other connections
  - 53B20 Local Riemannian geometry
  - 53B21 Methods of Riemannian geometry
  - 53B25 Local submanifolds [See also 53C40.]
  - 53B30 Lorentz metrics, indefinite metrics
  - 53B35 Hermitian and Kählerian structures [See also 32Cxx.]
  - 53B40 Finsler spaces and generalizations (areal metrics)
  - 53B50 Applications to physics
  - 53B99 None of the above, but in this section
- 53Cxx Global differential geometry [See also 51H25, 58-XX; for related bundle theory, see 55Rxx, 57Rxx.]**
  - 53C05 Connections
  - 53C10  $G$ -structures
  - 53C15 Almost complex, contact, symplectic, almost product structures, etc.
  - 53C20 Riemannian manifolds, including pinching [See also 31C12, 58B20.]
  - 53C21 Methods of Riemannian geometry
  - 53C22 Geodesics [See also 58E10.]
  - 53C25 Special Riemannian manifolds (Einstein, Sasakian, etc.)
  - 53C30 Homogeneous manifolds [See also 14M15, 14M17, 32M10, 57T15.]
  - 53C35 Symmetric spaces [See also 32M15, 57T15.]
  - 53C40 Submanifolds [See also 53B25.]
  - 53C42 Immersions (minimal, prescribed curvature, tight, etc.) [See also 49F10, 53A10, 57R40, 57R42.]
  - 53C45 Global surface theory (convex surfaces à la A. D. Aleksandrov)
  - 53C50 Lorentz manifolds, manifolds with indefinite metrics
  - 53C55 Hermitian and Kählerian manifolds [See also 32Cxx.]
  - 53C60 Finsler spaces and generalizations (areal metrics) [See also 58B20.]
  - 53C65 Integral geometry [See also 52A22, 60D05.]; differential forms, currents, etc. [See mainly 58Axx.]
  - 53C70 Direct methods ( $G$ -spaces of Busemann, etc.)

- 53C75 Geometric orders, order geometry [See also 51Lxx.]
- 53C80 Applications to physics
- 53C99 None of the above, but in this section

**54-XX GENERAL TOPOLOGY {For the topology of manifolds of all dimensions, see 57Nxx.}**

- 54-01 Elementary exposition, textbooks
- 54-02 Advanced exposition (research surveys, monographs, etc.)
- 54-03 Historical (must also be assigned at least one classification number from Section 01)
- 54-04 Explicit machine computation and programs (not the theory of computation or programming)
- 54-06 Proceedings, conferences, etc.
- 54Axx Generalities**
  - 54A05 Topological spaces and generalizations (closure spaces, etc.)
  - 54A10 Change of topology, comparison of topologies
  - 54A15 Syntopogeneous structures
  - 54A20 Convergence (general theory) and limits
  - 54A25 Cardinality properties (discrete subsets, weight, etc.), ultrafilters, etc. [See also 03Exx, 04A30.]
  - 54A35 Consistency and independence results [See also 03E35.]
  - 54A40 Fuzzy topology [See also 03E72.]
  - 54A99 None of the above, but in this section
- 54Bxx Basic constructions**
  - 54B05 Subspaces
  - 54B10 Product spaces
  - 54B15 Quotient spaces, decompositions
  - 54B17 Adjunction spaces and similar constructions
  - 54B20 Hyperspaces
  - 54B25 Sums, inverse limits
  - 54B30 Categorical methods [See also 18B30.]
  - 54B35 Spectra
  - 54B40 Presheaves and sheaves [See also 18F20.]
  - 54B99 None of the above, but in this section
- 54Cxx Maps and general types of spaces defined by maps**
  - 54C05 Continuous maps
  - 54C08 Connectivity maps, semicontinuous maps, etc.
  - 54C10 Special maps: open, closed, perfect, almost open, light, etc.
  - 54C15 Retraction
  - 54C20 Extension
  - 54C25 Imbedding
  - 54C30 Real-valued functions [See also 26-XX.]
  - 54C35 Function spaces [See also 58D15.]
  - 54C40  $C(X)$ ; algebraic techniques (ideals, etc.) [See also 46J10.]
  - 54C45  $C$ - and  $C^*$ -imbedding
  - 54C50 Zero sets, Baire sets and functions [See also 26A21.]
  - 54C55 Absolute neighborhood extensor, absolute extensor, absolute neighborhood retract (ANR), absolute retract spaces (general properties) [See also 54F40, 55M15.]
  - 54C56 Shape theory [See mainly 55P55, 57N25.]
  - 54C60 Set-valued maps [See also 26E25, 28B20.]
  - 54C65 Selections [See also 28B20.]
  - 54C70 Entropy
  - 54C99 None of the above, but in this section
- 54Dxx Fairly general properties**
  - 54D05 Connected and locally connected spaces (general aspects)
  - 54D10 Separation axioms,  $T_0 - T_3$
  - 54D15 Higher separation axioms (completely regular, normal, perfectly or collectionwise normal, etc.)
  - 54D18 Paracompactness, pointwise paracompactness, etc.
  - 54D20 Covering properties: Lindelöf,  $(m, n)$ -compact, etc.
  - 54D25 " $P$ -minimal" and " $P$ -closed" spaces
  - 54D30 Compact spaces and generalizations
  - 54D35 Compactifications, etc.
  - 54D40 Remainders
  - 54D45 Local compactness,  $\sigma$ -compactness
  - 54D50  $k$ -spaces
  - 54D55 Sequential spaces
  - 54D60 Realcompactness and realcompactification
  - 54D99 None of the above, but in this section



- 54Exx Spaces with richer structures**
- 54E05 Proximity structures and generalizations
  - 54E10  $p$ -maps
  - 54E15 Uniform structures and generalizations
  - 54E17 Nearness spaces
  - 54E18  $p$ -spaces,  $M$ -spaces,  $\sigma$ -spaces, etc.
  - 54E20 Stratifiable spaces, cosmic spaces, etc.
  - 54E25 Semimetric spaces
  - 54E30 Moore spaces
  - 54E35 Metric spaces, metrizability
  - 54E40 Isometries, contractions, expansions
  - 54E45 Compact (locally compact) metric spaces
  - 54E50 Complete metric spaces
  - 54E52 Completions, Baire category
  - 54E55 Bitopologies
  - 54E60 CW-complexes, triangulable spaces
  - 54E65 Countability conditions, separability
  - 54E99 None of the above, but in this section
- 54Fxx Special properties**
- 54F05 Ordered topological spaces, partially ordered spaces [See also 06B30, 06F30.]
  - 54F15 Continua and generalizations
  - 54F20 Special types of continua
  - 54F25 Peano spaces and generalizations
  - 54F30 Cyclic elements
  - 54F35 Higher dimensional local connectedness [See also 55Mxx, 55Nxx.]
  - 54F40 Compact (locally compact) absolute neighborhood retracts
  - 54F43 Shape theory [See mainly 55P55, 57N25.]
  - 54F45 Dimension theory [See also 55M10.]
  - 54F50 Spaces of dimension  $\leq 1$ ; curves, dendrites [See also 26A03.]
  - 54F55 Unicoherence, multicoherence
  - 54F60 Maps into  $S_n$
  - 54F62 Periodic maps
  - 54F65 Topological characterizations of particular spaces
  - 54F99 None of the above, but in this section
- 54Gxx Peculiar spaces**
- 54G05 Extremely disconnected spaces,  $F$ -spaces, etc.
  - 54G10  $P$ -spaces
  - 54G15 Pathological spaces
  - 54G20 Counterexamples
  - 54G99 None of the above, but in this section
- 54Hxx Connections with other structures, applications**
- 54H05 Descriptive set theory (topological aspects of Borel, analytic, projective, etc. sets) [See also 03E15, 04A15, 26A21, 28A05.]
  - 54H10 Topological representations of algebraic systems [See also 22-XX.]
  - 54H12 Topological lattices, etc. [See also 06B30, 06F30.]
  - 54H13 Topological fields, rings, etc. (For algebraic aspects, see 12Jxx, 13Jxx, 16A80.)
  - 54H15 Transformation groups and semigroups [See also 20M20, 22-XX, 57Sxx.]
  - 54H20 Topological dynamics [See also 28Dxx, 34C35, 58Fxx.]
  - 54H25 Fixed-point and coincidence theorems [See also 47H10, 55M20.]
  - 54H99 None of the above, but in this section
- 54J05 Nonstandard topology [See also 03Hxx.]**
- 55-XX ALGEBRAIC TOPOLOGY**
- 55-01 Elementary exposition, textbooks
  - 55-02 Advanced exposition (research surveys, monographs, etc.)
  - 55-03 Historical (must also be assigned at least one classification number from Section 01)
  - 55-04 Explicit machine computation and programs (not the theory of computation or programming)
  - 55-06 Proceedings, conferences, etc.
- 55Mxx Classical topics {For the topology of Euclidean spaces and manifolds, see 57N05, 57N10, 57N15.}**
- 55M05 Duality
  - 55M10 Dimension theory [See also 54F45.]
  - 55M15 Absolute neighborhood retracts [See also 54C55, 54F40.]
  - 55M20 Fixed points and coincidences [See also 54H25.]
  - 55M25 Degree, winding number
  - 55M30 Ljusternik-Schnirelman (Šnirel'man) category of a space
  - 55M35 Finite groups of transformations (including Smith theory) [See also 57S17.]
  - 55M99 None of the above, but in this section
- 55Nxx Homology and cohomology theories [See also 57Txx.]**
- 55N05 Čech types
  - 55N07 Steenrod-Sitnikov homologies
  - 55N10 Singular theory
  - 55N15  $K$ -theory (For algebraic  $K$ -theory, see 18F25.)
  - 55N20 Generalized (extraordinary) homology and cohomology theories
  - 55N22 Bordism and cobordism theories, formal group laws [See also 14L05, 57R75, 57R77, 57R85, 57R90.]
  - 55N25 Homology with local coefficients, equivariant cohomology
  - 55N30 Sheaf cohomology [See also 18F20, 32C35, 32L10.]
  - 55N35 Other homology theories
  - 55N40 Axioms for homology theory and uniqueness theorems
  - 55N45 Products and intersections
  - 55N99 None of the above, but in this section
- 55Pxx Homotopy theory {For simple homotopy type, see 57Q10.}**
- 55P05 Homotopy extension properties, cofibrations
  - 55P10 Homotopy equivalences
  - 55P15 Classification of homotopy type
  - 55P20 Eilenberg-Mac Lane spaces
  - 55P25 Spanier-Whitehead duality
  - 55P30 Eckmann-Hilton duality
  - 55P35 Loop spaces
  - 55P40 Suspensions
  - 55P42 Stable homotopy theory, spectra
  - 55P45  $H$ -spaces and duals
  - 55P47 Infinite loop spaces
  - 55P50 Category and cocategory, etc.
  - 55P55 Shape theory [See also 54C56, 54F43, 55Q07.]
  - 55P60 Localization and completion
  - 55P62 Rational homotopy theory
  - 55P65 Homotopy functors
  - 55P99 None of the above, but in this section
- 55Qxx Homotopy groups**
- 55Q05 Homotopy groups, general; sets of homotopy classes
  - 55Q07 Shape groups
  - 55Q10 Stable homotopy groups
  - 55Q15 Whitehead products and generalizations
  - 55Q20 Homotopy groups of wedges, joins, and simple spaces
  - 55Q25 Hopf invariants
  - 55Q30 Homotopy groups of triads,  $n$ -ads
  - 55Q35 Operations in homotopy groups
  - 55Q40 Homotopy groups of spheres
  - 55Q45 Stable homotopy of spheres
  - 55Q50 The  $J$ -morphism
  - 55Q52 Homotopy groups of special spaces
  - 55Q55 Cohomotopy groups
  - 55Q70 Homotopy groups of special types [See also 55N05, 55N07.]
  - 55Q99 None of the above, but in this section
- 55Rxx Fiber spaces and bundles [See also 18F15, 32Lxx, 46M20, 57R20, 57R22, 57R25.]**
- 55R05 Fiber spaces
  - 55R10 Fiber bundles
  - 55R15 Classification
  - 55R20 Spectral sequences and homology of fiber spaces [See also 55Txx.]
  - 55R25 Sphere bundles and vector space bundles
  - 55R35 Classifying spaces of groups and  $H$ -spaces
  - 55R40 Homology of classifying spaces, characteristic classes [See also 57Txx, 57R20.]
  - 55R45 Homology and homotopy of  $BO$  and  $BU$ ; Bott periodicity
  - 55R50 Stable classes of vector space bundles,  $K$ -theory (For algebraic  $K$ -theory, see 18F25.)
  - 55R55 Fiberings with singularities

- 55R60 Microbundles and block bundles [See also 57N55, 57Q50.]  
 55R65 Generalizations of fiber spaces and bundles  
 55R99 None of the above, but in this section
- 55Sxx Operations and obstructions**  
 55S05 Primary cohomology operations  
 55S10 Steenrod algebra  
 55S12 Dyer-Lashof operations  
 55S15 Symmetric products, cyclic products  
 55S20 Secondary and higher cohomology operations  
 55S25  $K$ -theory operations and generalized cohomology operations  
 55S30 Massey products  
 55S35 Obstruction theory  
 55S36 Extension and compression of mappings  
 55S37 Classification of mappings  
 55S40 Sectioning fiber spaces and bundles  
 55S45 Postnikov systems,  $k$ -invariants  
 55S99 None of the above, but in this section
- 55Txx Spectral sequences [See also 18G40, 55R20.]**  
 55T05 General  
 55T10 Serre spectral sequences  
 55T15 Adams spectral sequences  
 55T20 Eilenberg-Moore spectral sequences [See also 57T35.]  
 55T25 Generalized cohomology  
 55T99 None of the above, but in this section
- 55Uxx Applied homological algebra and category theory [See also 18Gxx.]**  
 55U05 Abstract complexes  
 55U10 Semisimplicial complexes  
 55U15 Chain complexes  
 55U20 Universal coefficient theorems, Bockstein operator  
 55U25 Homology of a product, Künneth formula  
 55U30 Duality  
 55U35 Abstract homotopy theory  
 55U40 Topological categories  
 55U99 None of the above, but in this section
- 57-XX MANIFOLDS AND CELL COMPLEXES (For complex manifolds, see 32C10.)**  
 57-01 Elementary exposition, textbooks  
 57-02 Advanced exposition (research surveys, monographs, etc.)  
 57-03 Historical (must also be assigned at least one classification number from Section 01)  
 57-04 Explicit machine computation and programs (not the theory of computation or programming)  
 57-06 Proceedings, conferences, etc.
- 57Mxx Low-dimensional topology (old 55Axx)**  
 57M05 Fundamental group, presentations, free differential calculus  
 57M10 Covering spaces  
 57M12 Special coverings, e.g. branched  
 57M15 Relations with graph theory [See also 05Cxx.]  
 57M20 Two-dimensional complexes  
 57M25 Knots and links in  $S^3$  (For higher dimensions, see 57Q45.)  
 57M30 Wild knots and surfaces, etc., wild imbeddings  
 57M35 Dehn's Lemma, sphere theorem, loop theorem, asphericity  
 57M40 Characterizations of  $E^3$  and  $S^3$  (Poincaré conjecture) [See also 57N12.]  
 57M99 None of the above, but in this section
- 57Nxx Topological manifolds**  
 57N05 Topology of  $E^2$ , 2-manifolds  
 57N10 Topology of general 3-manifolds [See also 57Mxx.]  
 57N12 Topology of  $E^3$  and  $S^3$  [See also 57M40.]  
 57N15 Topology of  $E^n$ ,  $n$ -manifolds ( $3 < n < \infty$ )  
 57N17 Topology of topological vector spaces  
 57N20 Topology of infinite-dimensional manifolds [See also 58Bxx.]  
 57N25 Shapes [See also 54C56, 54F43, 55P55, 55Q07.]  
 57N30 Engulfing  
 57N35 Imbeddings and immersions  
 57N37 Isotopy and pseudo-isotopy  
 57N40 Neighborhoods of submanifolds  
 57N45 Flatness and tameness
- 57N50  $S^{n-1} \subset E^n$ , Schoenflies problem  
 57N55 Microbundles and block bundles [See also 55R60, 57Q50.]  
 57N60 Cellularity  
 57N65 Algebraic topology of manifolds  
 57N70 Cobordism and concordance  
 57N75 General position and transversality  
 57N80 Stratifications  
 57N99 None of the above, but in this section
- 57Pxx Generalized manifolds [See also 18F15.]**  
 57P05 Local properties  
 57P10 Poincaré duality spaces  
 57P99 None of the above, but in this section
- 57Qxx PL-topology**  
 57Q05 The general topology of complexes  
 57Q10 Simple homotopy type, Whitehead torsion, Reidemeister-Franz torsion, etc.  
 57Q15 Triangulating manifolds  
 57Q20 Cobordism  
 57Q25 Comparison of PL-structures: classification, Hauptvermutung  
 57Q30 Engulfing  
 57Q35 Imbeddings and immersions  
 57Q37 Isotopy  
 57Q40 Regular neighborhoods  
 57Q45 Knots and links (in high dimensions) (For the low-dimensional case, see 57M25.)  
 57Q50 Microbundles and block bundles [See also 55R60, 57N55.]  
 57Q55 Approximations  
 57Q60 Cobordism and concordance  
 57Q65 General position and transversality  
 57Q99 None of the above, but in this section
- 57Rxx Differential topology (For foundational questions of differentiable manifolds, see 58Axx; for infinite-dimensional manifolds, see 58Bxx.)**  
 57R05 Triangulating  
 57R10 Smoothing  
 57R12 Smooth approximations  
 57R15 Specialized structures on manifolds (spin manifolds, frame manifolds, etc.)  
 57R20 Characteristic classes and numbers  
 57R22 Topology of vector bundles and fiber bundles [See also 55Rxx.]  
 57R25 Vector fields, frame fields, etc.  
 57R27 Controllability of vector fields on  $C^\infty$  and real-analytic manifolds [See also 49E15, 49F15.]  
 57R30 Foliations; geometric theory  
 57R32 Classifying spaces for foliations; Gel'fand-Fuks cohomology  
 57R35 Differentiable mappings  
 57R40 Imbeddings  
 57R42 Immersions  
 57R45 Singularities of differentiable mappings  
 57R50 Diffeomorphisms  
 57R52 Isotopy  
 57R55 Differentiable structures  
 57R60 Homotopy spheres, Poincaré conjecture  
 57R65 Surgery and handlebodies  
 57R67 Surgery obstructions, Wall groups [See also 18F25.]  
 57R70 Critical points and critical submanifolds  
 57R75 O- and SO-cobordism  
 57R77 Complex cobordism (U- and SU-cobordism) [See also 55N22.]  
 57R80  $h$ - and  $s$ -cobordism  
 57R85 Equivariant cobordism  
 57R90 Other types of cobordism [See 55N22.]  
 57R95 Realizing cycles by submanifolds  
 57R99 None of the above, but in this section
- 57Sxx Topological transformation groups [See also 20F34, 22-XX, 54H15, 58D05.]**  
 57S05 Topological properties of groups of homeomorphisms  
 57S10 Compact groups of homeomorphisms  
 57S15 Compact Lie groups of differentiable transformations  
 57S17 Finite transformation groups



- 57S20 Noncompact Lie groups of transformations  
 57S25 Groups acting on specific manifolds  
 57S30 Discontinuous groups of transformations  
 57S99 None of the above, but in this section
- 57Txx Homology and homotopy of topological groups and related structures**  
 57T05 Hopf algebras [See also 16A24.]  
 57T10 Homology and cohomology of Lie groups  
 57T15 Homology and cohomology of homogeneous spaces of Lie groups  
 57T20 Homotopy groups of topological groups and homogeneous spaces  
 57T25 Homology and cohomology of  $H$ -spaces  
 57T30 Bar and cobar constructions [See also 18G55, 55Uxx.]  
 57T35 Applications of Eilenberg-Moore spectral sequences [See also 55R20, 55T20.]  
 57T99 None of the above, but in this section
- 58-XX GLOBAL ANALYSIS, ANALYSIS ON MANIFOLDS**  
 [See also 32Cxx, 32Fxx, 46-XX, 47Hxx, 53Cxx; for geometric integration theory, see 49F20, 49F22.]
- 58-01 Elementary exposition, textbooks  
 58-02 Advanced exposition (research surveys, monographs, etc.)  
 58-03 Historical (must also be assigned at least one classification number from Section 01)  
 58-04 Explicit machine computation and programs (not the theory of computation or programming)  
 58-06 Proceedings, conferences, etc.
- 58Axx General theory of differentiable manifolds**  
 58A05 Differentiable manifolds, foundations  
 58A07 Real-analytic and Nash manifolds [See also 32C05.]  
 58A10 Differential forms  
 58A12 de Rham theory [See also 14Fxx.]  
 58A14 Hodge theory [See also 14C30, 14Fxx, 32Cxx.]  
 58A15 Exterior differential systems (Cartan theory)  
 58A17 Pfaffian systems  
 58A20 Jets  
 58A25 Currents  
 58A30 Vector distributions (subbundles of the tangent bundles)  
 58A35 Stratified sets [See also 32Bxx, 58Cxx.]  
 58A40 Differential spaces  
 58A99 None of the above, but in this section
- 58Bxx Infinite-dimensional manifolds**  
 58B05 Homotopy and topological questions  
 58B10 Differentiability questions  
 58B12 Questions of holomorphy [See also 32-XX, 46G20.]  
 58B15 Fredholm structures [See also 47A53.]  
 58B20 Riemannian, Finsler and other geometric structures [See also 53C20, 53C60.]  
 58B25 Group structures and generalizations on infinite-dimensional manifolds [See also 22E65, 58D05.]  
 58B99 None of the above, but in this section
- 58Cxx Calculus on manifolds; nonlinear operators** [See also 47Hxx.]  
 58C05 Real-valued functions  
 58C06 Set valued and function-space valued mappings  
 58C07 Continuity properties of mappings  
 58C10 Holomorphic maps [See also 32-XX.]  
 58C15 Implicit function theorems; global Newton methods  
 58C20 Differentiation theory (Gâteaux, Fréchet, etc.) [See also 26Exx, 46Gxx.]  
 58C25 Differentiable maps  
 58C27 Singularities of differentiable maps [See also 14B05, 14E15, 32Bxx, 32C40, 32C45.]  
 58C28 Catastrophes [See also 57R70, 58Exx.]  
 58C30 Fixed point theorems [See also 47H10.]  
 58C35 Integration on manifolds; measures on manifolds [See also 28Cxx.]  
 58C40 Spectral theory; eigenvalue problems  
 58C99 None of the above, but in this section
- 58Dxx Spaces and manifolds of mappings (including nonlinear versions of 46Exx)**
- 58D05 Groups of diffeomorphisms and homeomorphisms as manifolds [See also 22E65, 57Q05.]  
 58D07 Groups and semigroups of nonlinear operators [See also 17B65, 47Dxx, 47H20.]  
 58D10 Spaces of imbeddings and immersions  
 58D15 Manifolds of mappings [See also 54C35.]  
 58D17 Manifolds of metrics (esp. Riemannian)  
 58D20 Measures (Gaussian, cylindrical, etc.) on manifolds of maps [See 28Cxx.]  
 58D25 Equations in function spaces; evolution equations [See also 34Gxx, 35K22, 35R15.]  
 58D30 Applications (in quantum mechanics (Feynman integrals), relativity, fluid dynamics, etc.)  
 58D99 None of the above, but in this section
- 58Exx Variational problems in infinite-dimensional spaces**  
 58E05 Abstract critical point theory (Morse theory, Ljusternik-Schnirelman (Šnirel'man) theory, etc.)  
 58E07 Abstract bifurcation theory  
 58E10 Applications to the theory of geodesics (problems in one independent variable)  
 58E11 Critical metrics  
 58E12 Applications to minimal surfaces (problems in two independent variables)  
 58E15 Application to extremal problems in several variables  
 58E17 Pareto optimality, etc., applications to economics  
 58E20 Harmonic maps  
 58E25 Applications to control theory (optimal and nonoptimal)  
 58E30 Variational principles  
 58E35 Variational inequalities (global problems)  
 58E99 None of the above, but in this section
- 58Fxx Ordinary differential equations on manifolds; dynamical systems** {For abstract and topological dynamics, see also 28D10, 34C35, 34C40, 54H20.}
- 58F05 Hamiltonian and Lagrangian systems; symplectic geometry  
 58F06 Geometric quantization (applications of representation theory)  
 58F07 Completely integrable systems (including systems with an infinite number of degrees of freedom)  
 58F09 Morse-Smale systems  
 58F10 Stability theory  
 58F11 Ergodic theory; invariant measures [See also 28Dxx.]  
 58F12 Structure of attractors (and repellers)  
 58F13 Strange attractors; chaos and other pathologies  
 58F14 Bifurcation theory and singularities  
 58F15 Hyperbolic structures (expanding maps, Anosov systems, etc.)  
 58F17 Geodesic flows  
 58F18 Relations with foliations  
 58F19 Eigenvalue and spectral problems  
 58F20 Periodic points and zeta functions  
 58F21 Limit cycles, etc.  
 58F22 Periodic solutions  
 58F25 Flows  
 58F27 Quasiperiodic flows  
 58F30 Perturbations  
 58F35 Invariance properties  
 58F40 Applications  
 58F99 None of the above, but in this section
- 58Gxx Partial differential equations on manifolds; differential operators** [See also 35-XX.]
- 58G05 Differential complexes [See also 35Nxx.]; elliptic complexes  
 58G07 Relations with hyperfunctions  
 58G10 Index theory and fixed point theorems  
 58G11 Heat and other parabolic equation methods  
 58G12 Exotic index theories [See also 46L05, 46L10, 46M20.]  
 58G15 Pseudodifferential and Fourier integral operators on manifolds  
 58G16 Hyperbolic equations  
 58G17 Propagation of singularities; initial value problems

- 58G20 Boundary value problems
- 58G25 Spectral problems; spectral geometry; scattering theory
- 58G30 Relations with special manifold structures (Riemannian, Finsler, etc.)
- 58G32 Diffusion processes and stochastic analysis on manifolds
- 58G35 Invariance properties
- 58G40 Applications
- 58G99 None of the above, but in this section
- 58Hxx Pseudogroups and general structures on manifolds**
- 58H05 Pseudogroups [See also 22E65.]
- 58H10 Cohomology of classifying spaces for pseudogroup structures (Spencer, Gel'fand-Fuks, etc.)
- 58H15 Deformations of structures [See also 32Gxx, 58G05.]
- 58H99 None of the above, but in this section
- 60-XX PROBABILITY THEORY AND STOCHASTIC PROCESSES (For additional applications, see 10Kxx, 62-XX, 90-XX, 92-XX, 93-XX, 94-XX. For numerical results, see 65U05.)**
- 60-01 Elementary exposition, textbooks
- 60-02 Advanced exposition (research surveys, monographs, etc.)
- 60-03 Historical (must also be assigned at least one classification number from Section 01)
- 60-04 Explicit machine computation and programs (not the theory of computation or programming)
- 60-06 Proceedings, conferences, etc.
- 60Axx Foundations of probability theory**
- 60A05 Axioms; other general questions
- 60A10 Probabilistic measure theory (For ergodic theory, see 28Dxx and 60Fxx.)
- 60A99 None of the above, but in this section
- 60Bxx Probability theory on algebraic and topological structures**
- 60B05 Probability measures on topological spaces
- 60B10 Convergence of probability measures
- 60B11 Probability theory on linear topological spaces [See also 28C20.]
- 60B12 Limit theorems for vector-valued random variables (infinite-dimensional case)
- 60B15 Probability measures on groups, Fourier transforms, factorization
- 60B99 None of the above, but in this section
- 60C05 Combinatorial probability**
- 60D05 Geometric probability, stochastic geometry, random sets [See also 52A22, 53C65.]**
- 60Exx Distribution theory [See also 62Exx, 62Hxx.]**
- 60E05 Distributions: general theory
- 60E07 Infinitely divisible distributions; stable distributions
- 60E10 Characteristic functions; other transforms
- 60E15 Inequalities (Čebyšev, Kolmogorov, etc.)
- 60E99 None of the above, but in this section
- 60Fxx Limit theorems [See also 28Dxx, 60B12.]**
- 60F05 Central limit and other weak theorems
- 60F10 Large deviations
- 60F15 Strong theorems [See also 28A65.]
- 60F17 Functional limit theorems; invariance theorems
- 60F20 Zero-one laws
- 60F25  $L^p$ -limit theorems
- 60F99 None of the above, but in this section
- 60Gxx Stochastic processes**
- 60G05 Foundations of stochastic processes
- 60G07 General theory of processes
- 60G10 Stationary processes
- 60G12 General second order processes
- 60G15 Gaussian processes
- 60G17 Sample path properties
- 60G20 Generalized stochastic processes
- 60G25 Prediction theory [See also 62M20.]
- 60G30 Continuity and singularity of induced measures
- 60G35 Applications (signal detection, filtering, etc.) [See also 62M20, 94Axx.]
- 60G40 Stopping times; optimal stopping problems; gambling theory [See also 62L15.]
- 60G42 Martingales with discrete parameter
- 60G44 Martingales with continuous parameter
- 60G46 Martingales and classical analysis
- 60G48 Generalizations of martingales
- 60G50 Sums of independent random variables
- 60G55 Point processes
- 60G57 Random measures
- 60G60 Random fields
- 60G99 None of the above, but in this section
- 60Hxx Stochastic analysis [See also 58G32.]**
- 60H05 Stochastic integrals
- 60H10 Stochastic ordinary differential equations [See also 34F05.]
- 60H15 Stochastic partial differential equations [See also 35R60.]
- 60H20 Stochastic integral equations
- 60H25 Random operators and equations
- 60H99 None of the above, but in this section
- 60Jxx Markov processes**
- 60J05 Markov processes with discrete parameter
- 60J10 Markov chains with discrete parameter
- 60J15 Random walk
- 60J20 Applications of discrete Markov processes (social mobility, learning theory, industrial processes, etc.)
- 60J25 Markov processes with continuous parameter
- 60J27 Markov chains with continuous parameter
- 60J30 Processes with independent increments
- 60J35 Transition functions, generators and resolvents [See also 47D05, 47D07.]
- 60J40 Hunt processes
- 60J45 Probabilistic potential theory [See also 31-XX.]
- 60J50 Boundary theory
- 60J55 Local time and additive functionals
- 60J57 Multiplicative functionals
- 60J60 Diffusion processes [See also 58G32.]
- 60J65 Brownian motion [See also 58G32.]
- 60J70 Applications of diffusion theory (population genetics, absorption problems, etc.)
- 60J75 Jump processes
- 60J80 Branching processes (Galton-Watson, birth-and-death, etc.)
- 60J85 Applications of branching processes [See also 60K30, 92A10, 92A15.]
- 60J99 None of the above, but in this section
- 60Kxx Special processes**
- 60K05 Renewal theory
- 60K10 Applications (reliability, demand theory, etc.)
- 60K15 Markov renewal processes, semi-Markov processes
- 60K20 Applications of Markov renewal processes (reliability, queueing networks, etc.) [See also 90B22, 90B25.]
- 60K25 Queueing theory [See also 68C15, 90B22.]
- 60K30 Applications (congestion, allocation, storage, traffic, etc.) [See also 60J80.]
- 60K35 Interacting random processes, statistical mechanics type models
- 60K99 None of the above, but in this section
- 62-XX STATISTICS (For numerical methods, see 65U05.)**
- 62-01 Elementary exposition, textbooks
- 62-02 Advanced exposition (research surveys, monographs, etc.)
- 62-03 Historical (must also be assigned at least one classification number from Section 01)
- 62-04 Explicit machine computation and programs (not the theory of computation or programming)
- 62-06 Proceedings, conferences, etc.
- 62-07 Data analysis
- 62Axx Foundations**
- 62A05 Invariance and group considerations
- 62A10 The likelihood approach
- 62A15 The Bayesian approach
- 62A20 The classical approach
- 62A25 The structural approach
- 62A30 The fiducial approach
- 62A99 None of the above, but in this section



- 62Bxx Sufficiency**  
 62B05 Sufficient statistics and fields  
 62B10 Statistical information theory  
 62B15 Comparison of experiments  
 62B20 Measure-theoretic results, etc.  
 62B99 None of the above, but in this section
- 62Cxx Decision theory [See also 90A05; for game theory, see 90Dxx.]**  
 62C05 General considerations  
 62C07 Complete class results  
 62C10 Bayesian problems; characterization of Bayes procedures  
 62C12 Empirical decision procedures  
 62C15 Admissibility  
 62C20 Minimax procedures  
 62C25 Compound decision problems  
 62C99 None of the above, but in this section
- 62D05 Sampling theory, sample surveys**
- 62Exx Distribution theory [See also 60Exx.]**  
 62E10 Characterization and structure theory  
 62E15 Exact distribution theory  
 62E20 Asymptotic distribution theory  
 62E25 Monte Carlo studies  
 62E30 Formal computational methods (polykays, etc.)  
 62E99 None of the above, but in this section
- 62Fxx Parametric inference**  
 62F03 Hypothesis testing  
 62F04 Small sample properties of tests  
 62F05 Asymptotic properties of tests  
 62F07 Ranking and selection  
 62F10 Point estimation  
 62F11 Small sample properties of estimators  
 62F12 Asymptotic properties of estimators  
 62F15 Bayesian inference  
 62F25 Tolerance and confidence regions  
 62F35 Robustness and adaptive procedures  
 62F99 None of the above, but in this section
- 62Gxx Nonparametric inference**  
 62G05 Estimation  
 62G10 Hypothesis testing  
 62G15 Tolerance and confidence regions  
 62G20 Asymptotic efficiency  
 62G25 Quick and easy methods  
 62G30 Order statistics; empirical distribution functions  
 62G99 None of the above, but in this section
- 62Hxx Multivariate analysis [See also 60Exx.]**  
 62H05 Characterization and structure theory  
 62H10 Distribution of statistics  
 62H12 Estimation  
 62H15 Hypothesis testing  
 62H17 Contingency  
 62H20 Measures of association (correlation, canonical correlation, etc.)  
 62H25 Factor analysis and principal components  
 62H30 Classification and discrimination; cluster analysis [See also 68Gxx.]  
 62H99 None of the above, but in this section
- 62Jxx Regression and correlation**  
 62J02 General nonlinear regression  
 62J05 Linear regression  
 62J07 Ridge regression; James-Stein estimators  
 62J10 Analysis of variance and covariance  
 62J15 Paired and multiple comparisons  
 62J99 None of the above, but in this section
- 62Kxx Experimental design [See also 05Bxx.]**  
 62K05 Optimal designs  
 62K10 Block designs  
 62K15 Factorial designs  
 62K99 None of the above, but in this section
- 62Lxx Sequential methods**  
 62L05 Sequential design  
 62L10 Sequential analysis  
 62L12 Sequential estimation
- 62L15 Optimal stopping [See also 60G40.]  
 62L20 Stochastic approximation  
 62L99 None of the above, but in this section
- 62Mxx Inference from stochastic processes**  
 62M02 Markov processes: hypothesis testing  
 62M05 Markov processes: estimation  
 62M07 Non-Markovian processes: hypothesis testing  
 62M09 Non-Markovian processes: estimation  
 62M10 Time series, auto-correlation, regression, etc. [See also 90A20.]  
 62M15 Spectral analysis of time series  
 62M20 Prediction [See also 60G25.]; filtering [See also 60G35, 93E10, 93E11.]  
 62M99 None of the above, but in this section
- 62Nxx Engineering statistics**  
 62N05 Reliability and life testing [See also 90B25.]  
 62N10 Quality control [See also 90Bxx.]  
 62N99 None of the above, but in this section
- 62Pxx Applications [See also 82-XX, 90-XX, 92-XX.]**  
 62P05 Actuarial mathematics  
 62P10 Biometrics  
 62P15 Psychometrics  
 62P20 Econometrics [See also 90Axx.]  
 62P25 Sociometrics  
 62P99 None of the above, but in this section
- 62Q05 Statistical tables**
- 65-XX NUMERICAL ANALYSIS**  
 65-01 Elementary exposition, textbooks  
 65-02 Advanced exposition (research surveys, monographs, etc.)  
 65-03 Historical (must also be assigned at least one classification number from Section 01)  
 65-04 Explicit machine computation and programs (not the theory of computation or programming)  
 65-06 Proceedings, conferences, etc.
- 65A05 Tables**
- 65Bxx Acceleration of convergence**  
 65B05 Extrapolation to the limit, deferred corrections  
 65B10 Summation of series  
 65B15 Euler-Maclaurin formula  
 65B20 Poisson formula, etc.  
 65B99 None of the above, but in this section
- 65Cxx Numerical simulation {For theoretical aspects, see 68Jxx.}**  
 65C05 Monte Carlo methods  
 65C10 Random number generation  
 65C20 Models, numerical methods  
 65C99 None of the above, but in this section
- 65Dxx Numerical approximation {Primarily algorithms; for theory, see 41-XX.}**  
 65D05 Interpolation  
 65D07 Splines  
 65D10 Smoothing, curve fitting  
 65D15 Algorithms for functional approximation  
 65D20 Computation of special functions, construction of tables  
 65D25 Numerical differentiation  
 65D30 Numerical integration  
 65D32 Quadrature and cubature formulas  
 65D99 None of the above, but in this section
- 65E05 Numerical methods in complex analysis (potential theory, etc.) {For numerical methods in conformal mapping, see 30C30.}**
- 65Fxx Numerical linear algebra**  
 65F05 Direct methods for linear systems and matrix inversion  
 65F10 Iterative methods for linear systems [See also 65N20.]  
 65F15 Eigenvalues, eigenvectors  
 65F20 Overdetermined systems, pseudoinverses  
 65F25 Orthogonalization  
 65F30 Other matrix algorithms  
 65F35 Matrix norms, conditioning, scaling [See also 15A12, 15A60.]

- 65F40 Determinants
- 65F99 None of the above, but in this section
- 65Gxx Error analysis**
  - 65G05 Roundoff error
  - 65G10 Interval and finite arithmetic
  - 65G99 None of the above, but in this section
- 65Hxx Nonlinear algebraic or transcendental equations**
  - 65H05 Single equations
  - 65H10 Systems of equations
  - 65H15 Eigenvalues, eigenvectors
  - 65H99 None of the above, but in this section
- 65Jxx Numerical analysis in abstract spaces**
  - 65J05 General
  - 65J10 Equations with linear operators (do not use 65Fxx)
  - 65J15 Equations with nonlinear operators (do not use 65Hxx)
  - 65J99 None of the above, but in this section
- 65Kxx Mathematical programming, optimization and variational techniques [See also 49Dxx, 90Cxx, 93-XX.]**
  - 65K05 Mathematical programming
  - 65K10 Optimization and variational techniques
  - 65K99 None of the above, but in this section
- 65Lxx Ordinary differential equations**
  - 65L05 Initial value problems
  - 65L07 Numerical investigation of stability of solutions
  - 65L10 Boundary value problems
  - 65L15 Eigenvalue problems
  - 65L20 Stability of numerical methods
  - 65L99 None of the above, but in this section
- 65Mxx Partial differential equations, initial value problems**
  - 65M05 Derivation of finite difference approximations
  - 65M10 Stability and convergence of difference methods
  - 65M15 Error bounds
  - 65M20 Method of lines
  - 65M25 Method of characteristics
  - 65M30 Improperly posed problems
  - 65M99 None of the above, but in this section
- 65Nxx Partial differential equations, boundary value problems**
  - 65N05 Derivation of finite difference approximations
  - 65N10 Stability and convergence of difference methods
  - 65N15 Error bounds
  - 65N20 Solution of difference equations [See also 65F10.]
  - 65N25 Eigenvalue problems
  - 65N30 Finite elements, Rayleigh-Ritz and Galerkin methods, finite methods
  - 65N35 Collocation and related methods
  - 65N40 Methods of lines
  - 65N45 Method of contraction of the boundary
  - 65N99 None of the above, but in this section
- 65P05 Partial differential equations, miscellaneous problems**
- 65Q05 Difference and functional equations, recurrence relations**
- 65Rxx Integral equations, integral transforms [See also 45Lxx.]**
  - 65R10 Integral transforms
  - 65R20 Integral equations
  - 65R99 None of the above, but in this section
- 65S05 Graphical methods**
- 65T05 Harmonic analysis and synthesis**
- 65U05 Numerical methods in probability and statistics**
- 65V05 Automated algorithms [See also 68C05.]**
- 68-XX COMPUTER SCIENCE (including AUTOMATA) {For papers involving machine computations and programs in a specific mathematical area, see section -04 in that area.}**
  - 68-01 Elementary exposition, textbooks
  - 68-02 Advanced exposition (research surveys, monographs, etc.)
  - 68-03 Historical (must also be assigned at least one classification number from Section 01)
- 68-04 Explicit machine computation and programs (not the theory of computation or programming)
- 68-06 Proceedings, conferences, etc.
- 68A05 Computers and computer systems**
- 68Bxx Software**
  - 68B05 General theory of programming
  - 68B10 Analysis of programs (schemata, semantics, correctness, etc.)
  - 68B15 Theory of data (filing, etc.)
  - 68B20 Supervisory systems, processing (serial, parallel, multi, structured, time-sharing operating systems)
  - 68B99 None of the above, but in this section
- 68Cxx Metatheory (excluding automata)**
  - 68C01 Formal systems
  - 68C05 Algorithms [See also 03-XX, 65V05.]
  - 68C15 Queueing, scheduling [See also 60K25.]
  - 68C20 Symbolic computation, algebraic computation
  - 68C25 Computational complexity and efficiency of algorithms
  - 68C30 Computable functions, unsolvability
  - 68C40 Turing machines, abstract processors [See also 03D10.]
  - 68C99 None of the above, but in this section
- 68Dxx Automata [See also 03D05, 18B20, 68F10.]**
  - 68D05 General theory
  - 68D15 Linear automata, sequential machines
  - 68D20 Tessellation automata, iterative arrays, cellular structure
  - 68D25 Stochastic and nondeterministic automata
  - 68D27 Playing automata, learning automata [See also 90Dxx, 68Gxx.]
  - 68D30 Algebraic theory of automata [See also 18B20, 20M35.]
  - 68D35 Other types of automata
  - 68D37 Decomposition theory
  - 68D40 Reduction problems
  - 68D45 Realizable functions and regular events
  - 68D50 Experiments, state-assignments
  - 68D90 Transition nets
  - 68D99 None of the above, but in this section
- 68Exx Discrete mathematics**
  - 68E05 Sorting, searching
  - 68E10 Graph theory [See also 05Cxx.]
  - 68E99 None of the above, but in this section
- 68Fxx Linguistics**
  - 68F05 Formal languages, grammars
  - 68F10 Automata in connection with languages [See also 03D05, 18B20, 68Dxx.]
  - 68F15 Stochastic models
  - 68F20 Semantics
  - 68F25 Parsing
  - 68F30 Translation of natural languages
  - 68F99 None of the above, but in this section
- 68Gxx Artificial intelligence [See also 62H30, 68D27.]**
  - 68G05 Learning and adaptive systems
  - 68G10 Pattern recognition, speech recognition
  - 68G15 Theorem proving [See also 03B35.]
  - 68G20 Problem solving
  - 68G99 None of the above, but in this section
- 68H05 Information retrieval**
- 68Jxx Simulation [See also 65Cxx.]**
  - 68J05 Simulation (analog, hybrid, etc.)
  - 68J10 Modeling
  - 68J99 None of the above, but in this section
- 68K05 Miscellaneous applications of computers**
- 70-XX MECHANICS OF PARTICLES AND SYSTEMS {For relativistic mechanics, see 83A05 and 83C10; for statistical mechanics, see 82-XX.}**
  - 70-01 Elementary exposition, textbooks
  - 70-02 Advanced exposition (research surveys, monographs, etc.)
  - 70-03 Historical (must also be assigned at least one classification number from Section 01)
  - 70-04 Explicit machine computation and programs (not the theory of computation or programming)



- 70-05 Experimental papers
- 70-06 Proceedings, conferences, etc.
- 70A05 Axiomatics, foundations**
- 70Bxx Kinematics [See also 53A17.]**
  - 70B05 Kinematics of a particle
  - 70B10 Kinematics of a rigid body
  - 70B15 Mechanisms and linkages
  - 70B99 None of the above, but in this section
- 70Cxx Statics**
  - 70C05 Forces, fields
  - 70C10 Potential energy
  - 70C99 None of the above, but in this section
- 70Dxx Dynamics of a particle [See also 70Hxx.]**
  - 70D05 Newtonian dynamics
  - 70D10 Lagrangian dynamics
  - 70D99 None of the above, but in this section
- 70Exx Dynamics of rigid bodies**
  - 70E05 Motion of the gyroscope
  - 70E10 Motion of projectiles and rockets
  - 70E15 Motion of a general rigid body
  - 70E20 Perturbation methods for Euler's equations
  - 70E25 Poincaré method
  - 70E99 None of the above, but in this section
- 70Fxx Dynamics of a system of particles, including celestial mechanics**
  - 70F05 Two-body problem
  - 70F07 Three-body problem
  - 70F10  $n$ -body problem
  - 70F15 Celestial mechanics
  - 70F20 Holonomic systems
  - 70F25 Nonholonomic systems
  - 70F30 Impulsive motion
  - 70F35 Collisions
  - 70F99 None of the above, but in this section
- 70Gxx General representations of dynamical systems [See also 58F05.]**
  - 70G05 Riemannian geometry, tensorial methods [See also 53A45, 53A50, 53B20.]
  - 70G10 Generalized coordinates
  - 70G15 Space of events
  - 70G20 Impulse-energy space
  - 70G25 Configuration space
  - 70G30 State space
  - 70G35 Phase space
  - 70G99 None of the above, but in this section
- 70Hxx Hamiltonian and Lagrangian mechanics [See also 58F05.]**
  - 70H05 Hamilton's equations
  - 70H10 Liouville's theorem
  - 70H15 Canonical transformations
  - 70H20 Hamilton-Jacobi equations
  - 70H25 Hamilton's principle
  - 70H30 Other variational principles
  - 70H35 Lagrange's equation of motion
  - 70H99 None of the above, but in this section
- 70Jxx Linear vibration theory**
  - 70J05 Finite degree of freedom systems
  - 70J10 Normal modes of vibrations
  - 70J15 Conservative systems
  - 70J20 Nonconservative systems
  - 70J25 Stability of oscillatory motions
  - 70J99 None of the above, but in this section
- 70Kxx Nonlinear oscillations**
  - 70K05 Phase plane analysis
  - 70K10 Limit cycles
  - 70K15 Ljapunov theorems
  - 70K20 Stability
  - 70K30 Nonlinear resonances
  - 70K99 None of the above, but in this section
- 70L05 Random vibrations [See also 93Exx.]**
- 70Mxx Orbital mechanics**
  - 70M05 Satellite problems
  - 70M10 Orbital stability
  - 70M99 None of the above, but in this section
- 70N05 Exterior ballistics**
- 70P05 Variable mass, rockets**
- 73-XX MECHANICS OF SOLIDS**
  - 73-01 Elementary exposition, textbooks
  - 73-02 Advanced exposition (research surveys, monographs, etc.)
  - 73-03 Historical (must also be assigned at least one classification number from Section 01)
  - 73-04 Explicit machine computation and programs (not the theory of computation or programming)
  - 73-05 Experimental papers
  - 73-06 Proceedings, conferences, etc.
- 73A05 Axiomatics, foundations**
- 73Bxx Continuum mechanics {For fluids, see 76Axx.}**
  - 73B05 Constitutive equations
  - 73B10 Isotropic functionals
  - 73B15 Rotational groups [See also 22Exx.]
  - 73B20 Simple materials
  - 73B25 Multipolar stress theory
  - 73B30 Thermodynamics of solids [See also 73U05; for gases and fluids, see 80-XX.]
  - 73B35 Random materials
  - 73B99 None of the above, but in this section
- 73Cxx Elasticity {For the biharmonic equation, see 31A30, 31B30; for acoustics, see 76Q05.}**
  - 73C02 Classical linear elasticity
  - 73C03 Complex variable techniques
  - 73C05 Stress functions
  - 73C10 Saint-Venant's principle
  - 73C15 Uniqueness theorems
  - 73C20 Strain energy methods
  - 73C25 Thermal stress problems
  - 73C30 Anisotropic bodies
  - 73C35 Mixed boundary value problems [See also 45F05.]
  - 73C40 Nonhomogeneous bodies and inclusions
  - 73C45 Stress concentrations
  - 73C50 Nonlinear elasticity
  - 73C99 None of the above, but in this section
- 73Dxx Wave propagation in and vibrations of solids**
  - 73D05 Impact and explosion problems [See also 76L05.]
  - 73D10 Integral transforms
  - 73D15 Dilatational and shear waves
  - 73D20 Surface waves
  - 73D25 Wave diffraction and dispersion
  - 73D30 Linear vibrations [See also 70Jxx.]
  - 73D35 Nonlinear vibrations [See also 70Kxx.]
  - 73D99 None of the above, but in this section
- 73Exx Plasticity**
  - 73E05 Yield criteria and flow rules
  - 73E10 Method of successive approximations
  - 73E15 Slip-line theory
  - 73E20 Limit analysis
  - 73E25 Creep
  - 73E99 None of the above, but in this section
- 73Fxx Viscoelasticity**
  - 73F05 Creep and relaxation functions
  - 73F10 Correspondence principle
  - 73F15 Time-dependent boundary value problems
  - 73F20 Aging of materials
  - 73F25 Environmental-dependent materials
  - 73F99 None of the above, but in this section
- 73Gxx Finite deformations**
  - 73G05 Finite elasticity
  - 73G10 Strain energy functions
  - 73G15 Finite viscoelasticity
  - 73G20 Metal forming problems
  - 73G99 None of the above, but in this section
- 73Hxx Stability (linear and nonlinear)**
  - 73H05 Buckling
  - 73H10 Dynamic stability
  - 73H99 None of the above, but in this section

- 73Jxx Aero- and hydroelasticity**  
 73J05 Interaction of aerodynamics and elasticity  
 73J06 Interaction of hydrodynamics and elasticity  
 73J10 Vibrations, flutter  
 73J15 Divergence  
 73J99 None of the above, but in this section
- 73Kxx Structural mechanics**  
 73K05 Beams, columns, rods  
 73K10 Plates, discs  
 73K12 Vibrations of beams, plates, etc.  
 73K15 Membranes, shells  
 73K20 Composite structures and materials  
 73K25 Finite element methods  
 73K30 Other numerical methods  
 73K35 Random excitation  
 73K40 Optimization  
 73K99 None of the above, but in this section
- 73Lxx Theory of shells**  
 73L05 Non-Euclidean geometry, tensorial methods [See also 53A45.]  
 73L10 Anisotropic shells  
 73L15 Shell dynamics  
 73L20 Vibrations of shells  
 73L99 None of the above, but in this section
- 73Mxx Fractural mechanics**  
 73M05 Brittle fracture, cracks  
 73M10 Fatigue  
 73M15 Ductile fracture  
 73M20 Material instability  
 73M99 None of the above, but in this section
- 73Nxx Geophysical solid mechanics [See also 86-XX.]**  
 73N05 Global dynamics  
 73N10 Earthquake problems  
 73N99 None of the above, but in this section
- 73Pxx Biomechanics of solids**  
 73P05 Mathematical models of biological materials  
 73P10 Mechanics response  
 73P99 None of the above, but in this section
- 73Q05 Soil mechanics**
- 73R05 Electromagnetic elasticity**
- 73Sxx Micromechanics of solids**  
 73S05 Dislocation theory  
 73S99 Other micromechanics
- 73T05 Contact problems**
- 73U05 Thermomechanics of solids [See also 73B30.]**
- 76-XX FLUID MECHANICS {For general continuum mechanics, see 73Bxx, or other parts of 73-XX.}**  
 76-01 Elementary exposition, textbooks  
 76-02 Advanced exposition (research surveys, monographs, etc.)  
 76-03 Historical (must also be assigned at least one classification number from Section 01)  
 76-04 Explicit machine computation and programs (not the theory of computation or programming)  
 76-05 Experimental papers  
 76-06 Proceedings, conferences, etc.
- 76Axx Foundations, constitutive equations, rheology [See also 35L65.]**  
 76A02 Foundations  
 76A05 Non-Newtonian fluids  
 76A10 Viscoelastic fluids  
 76A99 None of the above, but in this section
- 76Bxx Incompressible inviscid fluids, potential theory**  
 76B05 Airfoil theory  
 76B10 Jets and cavities, cavitation, free-streamline theory, water-entry problems, hydrofoil theory  
 76B15 Water waves, gravity waves; dispersion and diffraction, nonlinear interaction  
 76B20 Ship waves  
 76B25 Solitary and cnoidal waves  
 76B35 Random waves  
 76B99 None of the above, but in this section
- 76Cxx Incompressible inviscid fluids, vorticity flows**  
 76C05 Vorticity flows  
 76C10 Internal waves  
 76C15 Atmospheric waves  
 76C20 Rossby waves  
 76C99 None of the above, but in this section
- 76Dxx Incompressible viscous fluids**  
 76D05 Navier-Stokes equations [See also 35Q10.]  
 76D10 Boundary-layer theory  
 76D15 Boundary-layer separation and reattachment  
 76D20 Higher-order effects in boundary layers  
 76D25 Wakes and jets  
 76D30 Singular perturbation problems  
 76D35 Random waves  
 76D99 None of the above, but in this section
- 76Exx Hydrodynamic stability**  
 76E05 Stability of parallel flows  
 76E10 Inertial instability  
 76E15 Convective instability  
 76E20 Instability of geophysical and astrophysical flows  
 76E25 Magnetohydrodynamic and electrohydrodynamic instabilities  
 76E30 Nonlinear effects  
 76E99 None of the above, but in this section
- 76Fxx Turbulence [See also 58F13, 58F27, 60Gxx, 60Jxx.]**  
 76F05 Homogeneous isotropic turbulence  
 76F10 Shear flows  
 76F99 None of the above, but in this section
- 76Gxx General aerodynamics and subsonic flows**  
 76G05 Hodograph methods  
 76G10 Kármán-Tsien approximation  
 76G15 Iterative methods  
 76G20 Free-streamline theory  
 76G99 None of the above, but in this section
- 76H05 Transonic flows, limit lines**
- 76Jxx Supersonic flows**  
 76J05 Hodograph methods  
 76J10 Method of characteristics  
 76J99 None of the above, but in this section
- 76K05 Hypersonic flows**
- 76L05 Shock waves and blast waves [See also 73D05.]**
- 76M05 Nonhomotropic flows of compressible fluids**
- 76Nxx Compressible fluids and gas dynamics, general**  
 76N05 Boundary layer theory  
 76N10 Compressible fluids, general  
 76N15 Gas dynamics, general  
 76N99 None of the above, but in this section
- 76P05 Rarefied gas flows, Boltzmann equation [See also 82A05.]**
- 76Q05 Hydrodynamic sound, acoustics**
- 76Rxx Diffusion and convection [See also 60J60.]**  
 76R05 Forced convection  
 76R10 Free convection  
 76R99 None of the above, but in this section
- 76S05 Flows in porous media; filtration; seepage**
- 76T05 Two-phase and multiphase flows**
- 76U05 Rotating fluids**
- 76V05 Multiphase and stratified fluids**
- 76W05 Magnetohydrodynamics and electrohydrodynamics**
- 76X05 Ionized gas flow in electromagnetic fields; plasmas**
- 76Y05 Quantum hydrodynamics and relativistic hydrodynamics [See also 83C55, 85A30.]**
- 76Zxx Biological fluid mechanics**  
 76Z05 Physiological flows  
 76Z10 Biopropulsion in water and in air  
 76Z99 None of the above, but in this section
- 78-XX OPTICS, ELECTROMAGNETIC THEORY {For quantum optics, see 81K05.}**  
 78-01 Elementary exposition, textbooks  
 78-02 Advanced exposition (research surveys, monographs, etc.)  
 78-03 Historical (must also be assigned at least one classification number from Section 01)  
 78-04 Explicit machine computation and programs (not the



theory of computation or programming)

- 78-05 Experimental papers
- 78-06 Proceedings, conferences, etc.
- 78A02 Foundations
- 78A05 Geometric optics
- 78A10 Physical optics
- 78A15 Electron optics
- 78A20 Space charge waves
- 78A25 Electromagnetic theory, general
- 78A30 Electro- and magnetostatics
- 78A35 Motion of charged particles
- 78A40 Waves and radiation
- 78A45 Diffraction, scattering [See also 34E20 for WKB methods.]
- 78A50 Antennas, wave-guides
- 78A55 Technical applications
- 78A57 Mathematically heuristic optics and electromagnetic theory (must also be assigned at least one other classification number in this section)
- 78A99 Miscellaneous topics

## 80-XX CLASSICAL THERMODYNAMICS, HEAT

**TRANSFER (For thermodynamics of solids, see 73B30.)**

- 80-01 Elementary exposition, textbooks
- 80-02 Advanced exposition (research surveys, monographs, etc.)
- 80-03 Historical (must also be assigned at least one classification number from Section 01)
- 80-04 Explicit machine computation and programs (not the theory of computation or programming)
- 80-05 Experimental papers
- 80-06 Proceedings, conferences, etc.
- 80A05 Foundations
- 80A10 Classical thermodynamics
- 80A15 Thermodynamics of mixtures
- 80A20 Heat and mass transfer
- 80A25 Combustion, interior ballistics
- 80A30 Chemical kinetics
- 80A35 Mathematically heuristic classical thermodynamics (must also be assigned at least one other classification number in this section)
- 80A99 Miscellaneous topics

## 81-XX QUANTUM MECHANICS

- 81-01 Elementary exposition, textbooks
- 81-02 Advanced exposition (research surveys, monographs, etc.)
- 81-03 Historical (must also be assigned at least one classification number from Section 01)
- 81-04 Explicit machine computation and programs (not the theory of computation or programming)
- 81-05 Experimental papers
- 81-06 Proceedings, conferences, etc.

### 81Bxx Axiomatics, foundations, philosophy

- 81B05 General
- 81B10 Logical foundations of quantum mechanics
- 81B99 None of the above, but in this section

### 81Cxx General mathematical topics and methods in quantum mechanics

- 81C05 Closed and approximate solutions to the Schrödinger, Dirac, Klein-Gordon and other quantum mechanical equations
- 81C10 Selfadjoint operator theory in quantum mechanics; essential selfadjointness of the Hamiltonian
- 81C12 Perturbation theory for operators
- 81C15 Perturbation theory for differential equations
- 81C20 Probabilistic methods in quantum mechanics
- 81C30 Feynman integrals and graphs; applications of algebraic topology and algebraic geometry to these problems
- 81C35 Path integrals
- 81C40 General group representations motivated by physics but not covered by Section 81Gxx below; representations of concrete classical groups such as  $SL(n, C)$ ,  $U(p, q)$ , etc. [See also 20C35, 22E70.]
- 81C99 None of the above, but in this section

### 81Dxx General quantum mechanics

- 81D05 Commutation relations
- 81D10 Bethe-Salpeter equation

- 81D15 Current algebra
- 81D20 Broken symmetries
- 81D25 Covariant wave equations
- 81D99 None of the above, but in this section
- 81Exx Quantum field theory**
- 81E05 Axiomatic quantum field theory; operator algebras
- 81E10 Constructive quantum field theory; models of quantum fields (including Yang-Mills theories)
- 81E15 Renormalization theory
- 81E99 None of the above, but in this section
- 81Fxx Scattering theories**
- 81F05 2-body potential scattering theory [See also 34E20 for WKB methods.]
- 81F10  $n$ -body potential scattering theory
- 81F15  $S$ -matrix theory, etc.
- 81F20 Particle scattering theories
- 81F30 Dispersion theory, dispersion relations
- 81F99 None of the above, but in this section

### 81Gxx Particle physics (this covers all kinds of particles and interactions)

- 81G05 Strong interaction
- 81G10 Electromagnetic interaction
- 81G15 Weak interaction
- 81G20 Applications of group theory to elementary particles
- 81G25 Other elementary particle theory
- 81G30 Applications of group theory to nuclear physics
- 81G35 Other nuclear physics
- 81G40 Applications of group theory to atomic physics
- 81G45 Other atomic physics
- 81G50 Applications of group theory to molecular physics
- 81G55 Other molecular physics
- 81G99 None of the above, but in this section

### 81H05 Quantum mechanics of many-body systems

#### 81J05 Superconductivity and superfluidity

#### 81K05 Quantum optics

#### 81L05 Quantum electrodynamics

### 81M05 Relativistic theory

### 81N05 Mathematically heuristic quantum mechanics (must also be assigned at least one other classification number in this section)

## 82-XX STATISTICAL PHYSICS, STRUCTURE OF MATTER

- 82-01 Elementary exposition, textbooks
- 82-02 Advanced exposition (research surveys, monographs, etc.)
- 82-03 Historical (must also be assigned at least one classification number from Section 01)
- 82-04 Explicit machine computation and programs (not the theory of computation or programming)
- 82-05 Experimental papers
- 82-06 Proceedings, conferences, etc.
- 82A05 Mathematical general statistical mechanics
- 82A15 Mathematical quantum statistical mechanics
- 82A25 Phase transitions
- 82A30 Statistical thermodynamics [See also 80-XX.]
- 82A35 Irreversible thermodynamics [See also 81H05.]
- 82A40 Kinetic theory of gases
- 82A42 Random media
- 82A45 Plasma
- 82A50 Liquids
- 82A55 Solids
- 82A60 Crystals
- 82A65 Metals
- 82A67 Lattice statistics
- 82A70 Transport processes [See also 85A25.]
- 82A75 Nuclear reactor theory
- 82A77 Mathematically heuristic statistical physics (must also be assigned at least one other classification number in this section)
- 82A99 Miscellaneous topics

## 83-XX RELATIVITY

- 83-01 Elementary exposition, textbooks
- 83-02 Advanced exposition (research surveys, monographs, etc.)

- 83-03 Historical (must also be assigned at least one classification number from Section 01)
- 83-04 Explicit machine computation and programs (not the theory of computation or programming)
- 83-05 Experimental papers
- 83-06 Proceedings, conferences, etc.
- 83A05 Special relativity**
- 83B05 Observational and experimental questions**
- 83Cxx General relativity**
  - 83C05 Einstein's equations
  - 83C10 Equations of motion
  - 83C15 Closed form solutions
  - 83C20 Classes of solutions
  - 83C25 Approximation procedures, weak fields
  - 83C30 Asymptotic procedures (radiation, news functions, etc.)
  - 83C35 Gravitational waves
  - 83C40 Groups of motions, invariance groups, observation laws, etc.
  - 83C45 Quantization of the gravitational field
  - 83C50 Electromagnetic fields
  - 83C55 Hydrodynamics [See also 76Y05.]
  - 83C99 None of the above, but in this section
- 83D05 Relativistic gravitational theories other than Einstein's**
- 83Exx Unified field theories**
  - 83E05 Geometrodynamics
  - 83E10 Asymmetric field theories
  - 83E15 Five- and higher-dimensional theories
  - 83E99 None of the above, but in this section
- 83F05 Cosmology**
- 85-XX ASTRONOMY AND ASTROPHYSICS {For celestial mechanics, see 70F15.}**
  - 85-01 Elementary exposition, textbooks
  - 85-02 Advanced exposition (research surveys, monographs, etc.)
  - 85-03 Historical (must also be assigned at least one classification number from Section 01)
  - 85-04 Explicit machine computation and programs (not the theory of computation or programming)
  - 85-05 Experimental papers
  - 85-06 Proceedings, conferences, etc.
  - 85A04 General
  - 85A05 Galactic and stellar dynamics
  - 85A10 Astronautics
  - 85A15 Stellar structure
  - 85A20 Stellar atmospheres
  - 85A25 Radiative transfer
  - 85A30 Hydrodynamic and hydromagnetic problems [See also 76Y05.]
  - 85A35 Statistical astronomy
  - 85A40 Cosmology {For relativistic cosmology, see 83F05.}
  - 85A45 Radio astronomy
  - 85A99 Miscellaneous topics
- 86-XX GEOPHYSICS [See also 73Nxx, 76U05, 76V05.]**
  - 86-01 Elementary exposition, textbooks
  - 86-02 Advanced exposition (research surveys, monographs, etc.)
  - 86-03 Historical (must also be assigned at least one classification number from Section 01)
  - 86-04 Explicit machine computation and programs (not the theory of computation or programming)
  - 86-05 Experimental papers
  - 86-06 Proceedings, conferences, etc.
  - 86A04 General
  - 86A05 Hydrology, hydrography, oceanography [See also 76B15, 76B20, 76B25, 76C15, 76E20, 76Q05, 76Rxx, 76U05.]
  - 86A10 Meteorology [See also 76Bxx, 76C15, 76E20, 76N15, 76Q05, 76Rxx, 76U05, 76V05.]
  - 86A15 Seismology [See also 73Dxx, 73Fxx, 73Mxx, 73Nxx, 73Q05.]
  - 86A20 Potentials, prospecting [See also 76S05, 76W05.]
  - 86A25 Geo-electricity and geomagnetism [See also 78A25.]
  - 86A30 Geodesy, mapping problems
- 86A35 Atmospheric physics [See also 76C15, 76C20, 76E20, 76Rxx, 76U05, 76V05.]
- 86A99 Miscellaneous topics
- 90-XX ECONOMICS, OPERATIONS RESEARCH, PROGRAMMING, GAMES**
  - 90-01 Elementary exposition, textbooks
  - 90-02 Advanced exposition (research surveys, monographs, etc.)
  - 90-03 Historical (must also be assigned at least one classification number from Section 01)
  - 90-04 Explicit machine computation and programs (not the theory of computation or programming)
  - 90-06 Proceedings, conferences, etc.
  - 90Axx Mathematical economics {For econometrics, see 62P20.}**
    - 90A05 Decision theory [See also 62Cxx.]
    - 90A06 Preferences
    - 90A07 Theory of group behavior
    - 90A08 Social choice, voting
    - 90A09 Portfolio theory and financial economics
    - 90A10 Utility theory
    - 90A11 Production models
    - 90A12 Price theory
    - 90A14 Equilibrium theory
    - 90A15 Static economic models
    - 90A16 Dynamic economic models
    - 90A17 Multisectoral models
    - 90A19 Statistical models
    - 90A20 Economic time series analysis [See also 62M10.]
    - 90A30 Applications to problems of human society (air pollution, etc.)
    - 90A99 None of the above, but in this section
  - 90Bxx Operations research and management science**
    - 90B05 Logistics, inventory, storage
    - 90B10 Flows in networks, deterministic
    - 90B15 Flows in networks, probabilistic
    - 90B20 Highway traffic
    - 90B22 Queueing theory, service models, etc. [See also 60K25.]
    - 90B25 Reliability and maintenance [See also 60K20, 62N05.]
    - 90B30 Production theory
    - 90B35 Scheduling theory
    - 90B40 Search theory
    - 90B99 None of the above, but in this section
  - 90Cxx Mathematical programming {For papers emphasizing calculus of variations or involving abstract spaces, see 49Dxx. For numerical methods, see 65K05.}**
    - 90C05 Linear programming
    - 90C06 Large scale linear programming
    - 90C08 Special problems of linear programming (transportation and multi-index problems, etc.)
    - 90C09 Boolean programming
    - 90C10 Integer programming
    - 90C11 Mixed integer programming
    - 90C15 Programming in conditions of uncertainty, stochastic programming
    - 90C20 Quadratic programming
    - 90C25 Convex programming
    - 90C30 Nonlinear programming
    - 90C31 Sensitivity, parametric programming, multi-objective programming
    - 90C32 Fractional programming
    - 90C33 Linear and nonlinear complementarity problems
    - 90C35 Network programming, programming in networks
    - 90C39 Dynamic programming [See also 49Cxx.]
    - 90C40 Markov decision processes; Markov programming and Markov renewal programming
    - 90C48 Programming in abstract spaces
    - 90C50 Applications of mathematical programming
    - 90C99 None of the above, but in this section
  - 90Dxx Game theory [See also 49A45, 68D27.]**
    - 90D05 2-person games



- 90D10 *n*-person games, noncooperative
- 90D12 *n*-person games, cooperative, solution concepts
- 90D13 Infinite games
- 90D15 Multistage games, stochastic [See also 93E05.]
- 90D20 Multistage games, recursive
- 90D25 Differential games
- 90D26 Pursuit and evasion games
- 90D30 Utility theory [See also 90A10.]
- 90D35 Decision theory [See also 62Cxx, 90A05.]
- 90D40 Game theory models [See also 65Cxx, 68Cxx, 68Jxx.]
- 90D42 Positional and lattice games
- 90D45 Applications of game theory
- 90D99 None of the above, but in this section

**92-XX BIOLOGY AND BEHAVIORAL SCIENCES**

- 92-01 Elementary exposition, textbooks
- 92-02 Advanced exposition (research surveys, monographs, etc.)
- 92-03 Historical (must also be assigned at least one classification number from Section 01)
- 92-04 Explicit machine computation and programs (not the theory of computation or programming)
- 92-06 Proceedings, conferences, etc.
- 92A05 General biology [See also 73-XX, 76-XX, in particular 73Pxx, 76Zxx.]
- 92A07 Medical applications of biology
- 92A09 Physiology, biochemistry [See also 76-XX, in particular 76Z10, and 80A30.]
- 92A10 Genetics
- 92A15 Population dynamics, epidemiology
- 92A17 Ecology
- 92A20 Sociology
- 92A25 Psychology
- 92A27 Psychophysics
- 92A40 Chemistry [See also 80A30, 92A05, 92A09.]
- 92A90 Other applications

**93-XX SYSTEMS THEORY; CONTROL {For optimal control, see 49-XX.}**

- 93-01 Elementary exposition, textbooks
- 93-02 Advanced exposition (research surveys, monographs, etc.)
- 93-03 Historical (must also be assigned at least one classification number from Section 01)
- 93-04 Explicit machine computation and programs (not the theory of computation or programming)
- 93-06 Proceedings, conferences, etc.

**93Axx General**

- 93A05 Axiomatic system theory
- 93A10 General systems
- 93A13 Hierarchical systems
- 93A15 Large scale systems
- 93A20 Cascaded systems
- 93A99 None of the above, but in this section

**93Bxx Controllability, observability, and system structure**

- 93B05 Controllability
- 93B07 Observability
- 93B10 Canonical structure
- 93B15 Realizability of systems from input-output data
- 93B17 Transformation
- 93B20 Minimal systems representations
- 93B25 Algebraic theory of time-invariant systems
- 93B30 System identification
- 93B35 Sensitivity
- 93B40 Computational methods
- 93B50 Synthesis problems
- 93B55 Pole and zero placement problems
- 93B99 None of the above, but in this section

**93Cxx Control systems, guided systems**

- 93C05 Linear
- 93C10 Nonlinear
- 93C15 Systems governed by ordinary differential equations
- 93C20 Systems governed by partial differential equations
- 93C22 Systems governed by integral equations
- 93C25 Systems in abstract spaces
- 93C30 Systems governed by functional relations other than

- differential or integral equations
- 93C35 Multivariable systems
- 93C40 Adaptive
- 93C45 Time-invariant
- 93C50 Time-dependent
- 93C55 Discrete-time
- 93C57 Sampled-data
- 93C60 Continuous-time
- 93C99 None of the above, but in this section

**93Dxx Stability**

- 93D05 Ljapunov stability
- 93D10 Popov-type stability of feedback systems
- 93D15 Stabilization of systems by feedback
- 93D20 Asymptotic stability
- 93D25 Input-output approaches
- 93D99 None of the above, but in this section

**93Exx Stochastic systems and control**

- 93E03 Stochastic systems, general
- 93E05 Stochastic games, stochastic differential games
- 93E10 Estimation and detection
- 93E11 Filtering
- 93E12 System identification
- 93E14 Data smoothing
- 93E15 Stochastic stability
- 93E20 Optimal stochastic control
- 93E25 Computational methods
- 93E99 None of the above, but in this section

**94-XX INFORMATION AND COMMUNICATION, CIRCUITS**

- 94-01 Elementary exposition, textbooks
- 94-02 Advanced exposition (research surveys, monographs, etc.)
- 94-03 Historical (must also be assigned at least one classification number from Section 01)
- 94-04 Explicit machine computation and programs (not the theory of computation or programming)
- 94-06 Proceedings, conferences, etc.

**94Axx Communication, information**

- 94A05 Communication theory [See also 60G35.]
- 94A11 Application of orthogonal functions in communication
- 94A12 Characterization of signals
- 94A14 Modulation and demodulation
- 94A15 Information theory, general [See also 62B10.]
- 94A17 Measures of information, entropy
- 94A24 Coding theorems (Shannon theory)
- 94A29 Source coding
- 94A34 Distortion theory
- 94A40 Channel theory
- 94A50 Theory of questionnaires
- 94A99 None of the above, but in this section

**94Bxx Algebraic theory of error-correcting codes**

- 94B05 Linear codes, general
- 94B10 Convolutional codes
- 94B15 Cyclic codes
- 94B20 Burst-correcting codes
- 94B25 Combinatorial codes
- 94B30 Majority codes
- 94B35 Decoding
- 94B40 Arithmetic codes
- 94B45 Prefix, length-variable, comma-free codes
- 94B50 Synchronization error-correcting codes
- 94B60 Other types of codes
- 94B70 Error probability
- 94B99 None of the above, but in this section

**94Cxx Circuits, networks**

- 94C05 Analytic circuit theory
- 94C10 Switching theory, applications of Boolean algebra
- 94C15 Applications of graph theory [See also 05Cxx, 68D90, 68E10.]
- 94C30 Applications of design theory [See also 05Bxx.]
- 94C99 None of the above, but in this section

**94D05 Fuzzy sets and logic (in connection with questions of Section 94) [See also 03B52, 03E72.]**





# ERRATA AND ADDENDA

## Volume 36

#6659: **Lorch, L.**

Replace all occurrences of “ $x, \nu$ ” and “ $-x$ ” by “ $\kappa, \nu$ ” and “ $-\kappa$ ”.

## Volume 41

#3304: **Wallis, J.**

See also MR 1, 15.

## Volume 43

#2596: **Szczerba, L.; Szmielew, W.**

The author has found a mistake in Theorem 2.

#8070: **Bell, Harold**

Some errors have been corrected in the republication [MR 43 #8061].

## Volume 45

#164: **Suryanarayana, D.**

In the title, the second “ $\mu$ ” should read “ $\mu^*$ ”.

#8554: **Spence, E.**

See also MR 1, 15.

#9363: **Cambanis, S.; Liu, B.**

Reference should be made to Theorem 1 of H. O. Lancaster [MR 26 #4431].

## Volume 46

#2505: **Himmelberg, C. J.**

In line 2, delete first “of”. In line 4, “ $\Sigma_1, \Sigma_2$ ” should read “ $z_1, z_2$ ”.

#5248: **Mazurov, V. D.**

Translation of the title should read “Finite simple groups whose centralizers all have 2-length one”.

#6145: **Stachel, H.**

Delete the remark in braces.

#6234: **Kulkarni, R. S.**

Replace the last two sentences by “It is an open problem whether the theorem remains true if  $n$  is relaxed to  $n > 3$  and the analyticity assumption is removed.”

#7595: **Srivastava, H.; Singhal, J.**

See also MR 34 #7832.

#9483: **Kopeikina, T. B.**

In line 14, insert “and  $D(t)$ ” to read “If  $a(t)$ ,  $b(t)$  and  $D(t)$ ”.

#9504: **Verulava, Ju. Š.**

Replace “ $\xi$ ” by “ $\varphi$ ” (twice).

## Volume 47

#1933: **Thompson, J. G.**

This is not the final part. For parts IV, V, VI see MR 51 #5745.

#2043: **Goodman, A. W.**

The author asserts that the existence of the domain  $D(r)$  is implied by the method of proof.

#3581: **Tamura, T.; Hamilton, H. B.**

In (5) and (6),  $z$ ,  $u$ ,  $b$  and  $c$  should have existential quantifiers.

#3727: **Janda, J.**

In the first sentence, “uniform” should read “locally uniform”.

#5600: **Escassut, A.**

In line 6, “maximal ideals” should read “at least one maximal ideal”.

#7126: **Baker, J. W.**

In line 2, “ $p(t)ug(u)$ ” should read “ $p(t)u^ag(u)$ ”.

#8615: **Elliger, S.**

The theorem of the note is false. See K. R. Goodearl [MR 50 #402].

#8691: **Levič, E. M.**

There is a serious error in the paper, as indicated in RŽMat 1973, 3A, p. 32.

#8762: **Gardner, L. T.**

The result described as “the author’s central contribution” is, in fact, due to M. Rajagopalan [MR 29 #6250].

#9999: **Bellini Morante, A.**

The author states that the real eigenvalue may disappear (not “no eigenvalues exist”) if the body is small enough.

## Volume 48

#217: **Bohman J.**

In line 4, “six primes” should read “six consecutive primes”.

#1041: **Pavlick, F.**

The first sentence should read “This note proves the result of the title based on a result of E. Melchior [Deutsche Math. 5 (1941), 461–475; MR 3, 13]”.

#2093: **Pil’tjai, G. Z.**

Refer also to MR 33 #7314, 39 #5494 and 50 #4509.

#3732: **Schwabhäuser, W.**

The author claims that the Löwenheim-Skolem-Tarski theorem is on page 88 of the book under review.

#4108: **Gallian, J. A.**

In line 2, “ $2 < c < p$ ” should read “ $2 < p < c$ ”.

#4224: **Kuczma, Marek**

In the second reference, “the author” should read “Marcin E. Kuczma”.

#8391: **Borho, W.; Rosenberger, G.**

In line 1, “ $q = 3$ ” should read “ $q > 3$ ”.

#10956: **Williams, H. C.; Zarnke, C. R.**

In the title, read “ $x^3 + dy^3 = 1$ ”.

#11046: **Metsänkylä, T.**

In line 5, “I” should read “F”.

## Volume 49

#4475: **Bars, I.**

In the third line from the end, “ $(n, R)$ ” and “ $(n, C)$ ” should read “ $(n + 1, R)$ ” and “ $(n + 1, C)$ ”.

#6197: **Szymański, A.; Turzański, M.**

The authors claim that sufficiency is implied by an easy remark.

## Volume 50

#2469: **Abbadiev, F. G.; Aksent’ev, L. A.**

The first author’s name should read “Avhadiev”.

#2732: **Dhombres, J.**

In paragraph 2, line 2, “torus” should read “circle group”.

#4308: **Namba, K.**

Delete the last 9 lines of the review and add “extension), one can show stronger results, e.g. if  $H(\alpha)$  holds for some  $\alpha$ , then  $0^\#$  exists.”

#4913: **Daykin, D. E.; Wilansky, A.**

R. P. Kaufman and N. W. Rickert [MR 33 #1430] obtained the

constant  $1/\pi$ . The paper under review neither improves nor generalizes this.

#11243: **Montesinos, J. M.**

In paragraph 2, line 6, " $g+1$ " should read " $g+2$ ".

#12531: **Математика: Периодический сборник переводов иностранных статей.**

After the publication date "1972", add "183 pp."

#13281: **Levčuk, V. M.**

Insert "pp. 71–93," preceding "Akad. Nauk".

#14679: **Kucia, A.**

See also Corollary 3.10 of T. E. Gantner's paper [MR 36 #5886].

Pages 1291 and 2372: **Pelikán, J.**

Delete references to #8399.

### Volume 51

#1496: **Marino, A.**

The author claims that there is a mistake in the main theorem.

#3928: **Ball, J. A.**

#3945: **Coburn, L. A.**

The reviewer is D. N. Clark.

#9026: **Weller, G. P.**

A. H. Stone points out that the author needs strong paracompactness in place of paracompactness. Then see MR 15, 336. Compare MR 46 #6341.

#13752: **Gillespie, T. A.**

Delete the reviewer's remarks. The results in the paper are valid.

### Volume 53

#13348: **Pavel, Monique**

The reviewer line should read "*K. Fichtner* (Berlin)".

### Volume 54

#10924: **Jakimovski, A.; Russell, D. C.**

The authors prove ten theorems. The theorem mentioned in the review is quoted by the authors as being due to D. Borwein and F. P. Cass [J. London Math. Soc. (2) 13 (1976), no. 2, 205–208; MR 54 #5668].

### Volume 55

#3152: **Ng, Kai-Wang**

The paper appears to have been translated from Xia Dao-Xing [see pages 111–115 of the book reviewed as MR 46 #9281].

### Volume 56

#3266: **Džrbašjan, M. M.; Saakjan, B. A.**

The last sentence of the review is misleading and should be deleted.

#3673: **Kutateladze, S. S.**

Delete the remark in braces about a misprint.

#15252: **Foundations of probability theory, statistical inference, and statistical theories of science. Vol. II.**

The publication date "1977" should read "1976".

#16009: **Shah, Manilal**

There is a striking similarity between this and MR 50 #7607.

#17619: **Nakanishi, Noboru; Yamawaki, Koichi**

The reviewer wishes to withdraw his remark alleging an error in the proof of the authors' theorem; he regrets having inadvertently misread the authors' notation.

### Volume 57

#3110: **Loonstra, F.**

In line 10, "a subdirect product" should read "a subproduct".

#4223: **Guckenheimer, John**

#12034: **Allard, André**

In the journal line, "(1978)" should read "(1978/79)".

#4718: **Lipton, R. J.**

In the title line, "enforces" should read "enforcers".

#5701: **Demut, O. [Demuth, O.]**

In the third line from the end, " $(x, Ax)$ " should read " $(x, Fx)$ ".

#5860: **Länger, Helmut**

The last sentence should read, "The full  $n$ -place function algebra over some set  $S$  is  $C$ - $S$ -maximal if and only if it is not the case that both  $n=2$  and the cardinality of  $S$  is 2."

#12181: **Rybakov, V. V.**

In line 9, " $\{T(A) : A \in L\}$ " should read " $\{A : T(L) \vdash_{S_4} A\}$ ".

In (ii), insert "finitely" before "axiomatizable". Delete the reviewer's remark.

#12352: **Páley, P. P.**

The author's name should read "Pálffy".

#12645: **Aubert, K. E.; Fleischer, I.**

The cited exercise was intended to lead to a related body of folklore, and not to claim originality.

#13921: **Kahn, D. S.; Kaminker, J.; Schochet, C.**

The result attributed to Kaminker and Schochet [MR 55 #4138] is one of the principal results of the paper under review.

Subject classification "76 Fluid Mechanics, Acoustics" should begin at #14827 (not at #14822).

Subject classification "82 Statistical Physics, Structure of Matter" should begin at #15110 (not at #15049).

#15491: **Lucenko, M. M.**

In the third line from the end, " $(0, 1)$ " should read " $(\alpha, 1)$ ".

#17241: **Šneperman, L. B.**

In line 4, "subgroup" should read "semigroup".

#17537: **Gol'dberg, V. V.**

Throughout the review, the  $(n+1)$ -webs discussed are the specific  $(n+1)$ -webs  $W_h$ . The first four lines of the review should read "Let  $W_h$  be an  $(n+1)$ -web generated by  $n+1$   $r$ -dimensional surfaces of projective space  $P_{r+n-1}$ . The web surfaces of  $W_h$  are the sheaves of  $(n-1)$ -planes with centers on the  $r$ -surfaces."

### Volume 58

On pages 111 through 116, the running head "Algebraic Geometry" should read "Linear and Multilinear Algebra; Matrix Theory" and "14" should read "15".

#1083: **Flytzanis, E.**

#13364: **Elie, L.**

#8044: **Colomb, G.**

#18841: **Milhaud, X.**

#8049: **Fourt, G.**

#24456: **Schott, R.**

#13362: **Baldi, P.**

#24560: **Högnäs, G.**

#13363: **Bougerol, P.**

#26149: **Villard, M.**

The review for the entire collection is MR 58 #31327.

Subject classification "42 Fourier Analysis" should begin at #1936 (not at #1852).

#2061: **Al-Salam, W. A.; Ismail, Mourad E. H.**

Delete the remark in braces. There is no contradiction.

#2312: **Boyardžiev, H. N.**

The proof of Lemma 1 follows from the proof (using wedges in place of cones) of the cited theorem.



#4746, #4747, #4748:

These numbers were not used.

#4785: Knorr, Wilbur R.

#10113: Reid, Constance

#10156: Bateman, P.; Diamond, H.

#10158: Bers, Lipman

#10198: Müller, G. H.

#10224: Smale, S.

#13055: Connelly, Robert

#14029: Moser, Jürgen

#15841: Hamadanizadeh, Javad

In the journal line, "(1978)" should read "(1978/79)".

#5124: Smoryński, C.

In line 2, "polynomials" should read "exponential polynomials".

#5811: Serena, Luigi

In line 7, " $U(L) = L$ " should read " $U(L) = \{L\}$ ".

#6187: Džrbašjan, M. M.; Saakjan, B. A.

The review should read: "The authors correct some oversights in their paper [MR 56 #3266]. In particular, formulas (3.18), (3.19) are correct as stated if  $\mu_j = 1/p_j$ , but if  $\mu_j > 1/p_j$ , they need a supplementary hypothesis." The reviewer regrets having overlooked the main point of the letter.

#6270: Гахов, Ф. Д. [Gahov, F. D.]

In line 10, " $\Phi(t)$ " should read " $\Phi^+(t)$ ".

#6884: Swaminathan, V.

In line 3 in the displayed equation, " $\exp(z-1)$ " should read " $\exp \lambda_i(z-1)$ ".

#7362: Freudenthal, Hans

Replace the review by the following editorial note:

"The paper is a detailed critical analysis of a paper of E. M. Bruins [Euclides 39 (1963/64), 1–15]."

#7557: Simon, Petr

Replace the text with the following:

"In 1968 J. P. Thomas [J. Austral. Math. Soc. 8 (1968), 700–705; MR 38 #5177] raised the question: 'Does there exist a maximal connected Hausdorff topology on some space other than a singleton?' In the paper under review, the author proves that a maximal connected Hausdorff topology on an infinite set can exist. The author gives (Theorem 5) sufficient conditions for the existence of such a topology, and he proves that these conditions can be nonvacuously satisfied. In particular, he shows that there exists a maximal connected Hausdorff topology on the set of real numbers (Theorem 7)."

#9172: Frederickson, Greg N.; Hecht, Matthew S.; Kim, Chul E.

After the title line, add

"SIAM J. Comput. 7 (1978), no. 2, 178–193."

#10728: Orazov, M.

In the displayed formula, " $2x \log \log x$ " should read " $2x \log \log \log x$ ".

#11830: Levitin, N. N.

The authors name should read "Litvin".

#13063: Levitt, Norman; Rourke, Colin

In the fourth line from the end, "487" should read "497".

In the last two lines, "[see 'Spectral geometry of spaces with cone-like singularities', preprint]" should read "[Proc. Nat. Acad. Sci. U.S.A. 76 (1979), no. 5, 2103–2106]".

#13091: Hsiang, W. C.; Sharpe, R. W.

Delete the last sentence in the first full paragraph on p. 1976.

The reference in the reviewer's remark should read "[see D. Burghleia, *Algebraic and geometric topology* (Proc. Sympos. Pure Math., Stanford Univ., Stanford, Calif., 1976), Part 1, pp. 347–

371. Proc. Sympos. Pure Math., XXXII. Amer. Math. Soc., Providence, R.I., 1978]".

#13144: Wall, C. T. C.

In line 21, "distance-geometric" should read "distance-generic".

#13145: Wells, G. SZ

In lines 10 and 11, "which contains jo proofs" should be deleted.

#16317: Algorithmic studies in combinatorics

Delete reference to International Colloquium 1976.

#16481: Hudson, Richard H.

In line 7, " $S_n \lambda < \sqrt{p}$ " should read " $S_n < \sqrt{p}$ ".

#17040: Herman, M. R.

In line 5, "#3308" should read "#33081".

#17071: Abhadiev, F. G.

#17117: Abhadiev, F. G.

#17118: Abhadiev, F. G.

#17130: Kudrjašov, S. N.; Abhadiev, F. G.

The author's name should read "Avhadiev".

#18040: Brandi, Primo

In line 17, "under a single concept" should read "within a single scheme".

#18402b: Geometric applications of homotopy theory. II.

The heading repeats part I [18402a] except "657" should read "658", "vii + 459 pp." should read "viii + 487 pp." and "08858-X" should read "08859-8".

#18672: Gordin, M. I.; Lifšic, B. A.

In line 8, " $(S_n)$ " should read " $(f(X_1) + \cdots + f(X_n))$ ".

#19010: Rutishauser, H.

The formulas that the author derives and calls "Integration by the trapezoidal rule" are, in effect, the Crank-Nicholson formulas.

#21852: Lipton, Richard J.; Tarjan, Robert E.

In line 13, "in a plane" should read "on a face".

#21917: Aleksandrov, A. G.

Delete reference to Orsay Colloq.

#22316: Ribes, Luis

In lines 16 and 17, Theorem 4.2 should read "If  $G = G(K/k)$ , then  $G$  with Krull's topology is compact, Hausdorff and totally disconnected; namely,  $G$  is a profinite group."

#22447: Leese, S. J.

In line 12, " $S \times X$ " should read " $S \times X$ ".

#22773: Komkov, Vadim

In lines 2 and 3, "the equation  $(a(t)x')' + c(t) = 0$  is compared with that of  $(a(t)q(t)u')' + c(t)q(t) = 0$ " should read "the equation  $(a(t)x')' + c(t)x = 0$  is compared with that of  $(a(t)q(t)u')' + c(t)q(t)u = 0$ ".

#23116: Friedrichs, K. O.

In line 5, " $g_p^H(u)$ " should read " $q_p^H(u)$ ".

In line 10, " $r \geq s$ " should read " $r > s$ ".

#23526: Pelczyński, Aleksander

In line 81, "any power of  $n$ " should read "some power of  $n$ ".

#24344: Nožička, František

In line 2 " $d$ -dimensional spaces" should read " $d$ -dimensional surfaces".

#24946: Neumann, K. [Neumann, Klaus]

This paper was reviewed earlier [MR 50 #8976].

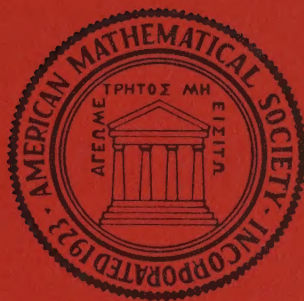
#27769b: Weil, A.

The author line should read "Вейль, А. [Vell, A.] [Weil, A.]".





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